

**EPA Superfund
Record of Decision:**

**OLD NAVY DUMP/MANCHESTER LABORATORY
(USEPA/NOAA)
EPA ID: WA8680030931
OU 01
MANCHESTER, WA
09/30/1997**

RECORD OF DECISION
Manchester Annex
Superfund Site
Manchester, Washington

Prepared for
U.S. Army Corps of Engineers
Seattle District

Contract No. DACA67-93-D-1004
Delivery Order No. 26

September 1997
J-4191-19

CONTENTS	Page
ACRONYMS AND ABBREVIATIONS	iv
DECLARATION	D-1
Site Name and Location	D-1
Statement of Basis and Purpose	D-1
Assessment of the Site	D-1
Description of the Selected Remedy	D-1
Statutory Determinations	D-3
DECISION SUMMARY	1
1.0 OVERVIEW	1
2.0 SITE LOCATION AND DESCRIPTION	1
3.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES	2
4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION	4
5.0 SCOPE AND ROLE OF RESPONSE ACTION	6
6.0 SUMMARY OF SITE CHARACTERISTICS	6
6.1 Landfill and Clam Bay Sediments	8
6.2 Fire Training Area	10
6.3 Net Depot and Manchester State Park	12
7.0 SUMMARY OF SITE RISKS	12
7.1 Human Health Risks	12
7.2 Ecological Risks	18
8.0 REMEDIAL ACTION OBJECTIVES	19
8.1 Need for Remedial Action	19
8.2 Landfill Area and Clam Say	20
8.3 Fire Training Area	21
8.4 Net Depot and Manchester State Park	22
8.5 Groundwater	23
8.6 Remediation Areas and Volumes	23
9.0 DESCRIPTION OF ALTERNATIVES	23
9.1 Alternatives for the Landfill and Clam Say Sediments	23
9.2 Alternatives for the Fire Training Area	27
9.3 Alternatives for the Net Depot and Manchester State Park	28
10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES	28
10.1 Evaluation of Landfill and Clam Bay Alternatives by Criteria	29
10.2 Evaluation of Fire Training Area Alternatives by Criteria	33
11.0 THE SELECTED REMEDY	35
11.1 Excavation of Intertidal Debris and Placement of Design Fill	35
11.2 Placement of Thick Sand Cap over Silt Basin Sediments	36
11.3 Placement of Thin Cap over Remaining Surficial Sediments Exceeding Cleanup Levels	36
11.4 Installation of Landfill Cap and Hydraulic Cutoff System	37
11.5 Excavation/Disposal of Dioxin-Contaminated Debris and Soil	38
11.6 In-Place Closure of USTs	38
11.7 Institutional Controls	39

12.0 STATUTORY DETERMINATIONS	40
12.1 Protection of Human Health and the Environment	41
12.2 Compliance with Applicable or Relevant and Appropriate Requirements	41
12.3 Cost Effectiveness	44
12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable	45
12.5 Preference for Treatment as Principal Element	45
13.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES	45
14.0 REFERENCES	45

TABLES

1 Listing of Chemicals of Potential Concern, Manchester Annex Site	48
2 Summary of Soil Quality Data for Landfill Area	49
3 Summary of Soil Quality Data for Fire Training Area	51
4 Summary of Soil Quality Data for Net Depot Area	53
5 Summary of Groundwater Quality Data for Landfill Area (Surficial Fill Unit)	55
6 Summary of Groundwater Quality Data for Outwash Channel Aquifer	56
7 Summary of Seep Quality Data for Landfill Area	59
8 Summary of Surface Water and Seep Quality Data for Fire Training Area	61
9 Summary of Surface Water and Seep Quality Data for Net Depot Area	62
10 Summary of Sediment Quality Data for Clam Bay	64
11 Summary of Tissue Quality Data for Clam Bay	66
12 Maximum Concentrations Detected in Site Media	67
13 TPH Soil-to-Leachate Ratios in Fire Training Area	68
14 Summary of Cumulative Baseline Cancer Risks and Hazard Indices, Manchester Annex Site	69
15 Summary of Manchester Annex Cleanup Levels and Cleanup Goals	70
16 Estimated Areas and Volumes Exceeding Soil and Sediment Cleanup Levels	71

FIGURES

1 Vicinity Map
2 Site Features Map
3 Geologic Cross Section
4 Groundwater Elevation Contour Map
5 Conceptual Model - Human Health Risk Assessment
6 Baseline Exposure Pathways
7 Areas Exceeding Soil and Sediment Cleanup Levels in Landfill and Clam Bay
8 Areas Exceeding Soil Cleanup Levels and Goals in Fire Training Area
9 Alternatives 2A and 3A Approximate Areal Extent of Landfill Cap and Hydraulic Cutoff System
10 Alternative 2A - Armoring over Intertidal Debris, Typical Section
11 Alternative 3A - Excavation of Intertidal Debris and Placement of Design Fill, Typical Section

ATTACHMENT A

RESPONSIVENESS SUMMARY

ACRONYMS AND ABBREVIATIONS

AET	apparent effects threshold
ARAR	applicable or relevant and appropriate requirements
BMP	best management practice
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Chemical of Potential Concern
Corps	U.S. Army Corps of Engineers
CPF	Cancer Potency Factor
DoD	Department of Defense
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FS	Feasibility Study
FUDS	Formerly Used Defense Site
GSA	General Services Administration
IAG	Interagency Agreement
IRIS	Integrated Risk Information System
MFS	minimum functional standards
MTCA	Model Toxics Control Act
NCP	National Contingency Plan
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
O&M	Operations and Maintenance
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PSDDA	Puget Sound Dredge Disposal Analysis
PSNS	Puget Sound Naval Shipyard
QA/QC	quality assurance/quality control
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SMS	Sediment Management Standards
SPLP	Synthetic Precipitation Leaching Procedure
SQS	Sediment Quality Standards
SWQS	State Water Quality Standards
TBC	to-be-considered
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbon
UCL	Upper Confidence Limit
USFWS	U.S. Fish and Wildlife Service
USGS	United State Geological Survey
UST	Underground Storage Tank
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife

Ig/kg	micrograms per kilogram
	equivalent to parts per billion (ppb)
mg/kg	milligrams per kilogram
	equivalent to parts per million (ppm)
Ig/L	micrograms per liter
	equivalent to parts per billion (ppb)
mg/L	milligrams per liter
	equivalent to parts per million (ppm)

DECLARATION

Site Name and Location

Manchester Annex Superfund Site
Manchester, Washington

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Old Navy Dump/Manchester Annex Superfund Site (Site) in Manchester, Washington. This remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Control Contingency Plan (NCP). This decision is based on the Administrative Record for the site.

The remedy was selected by the U.S. Army Corps of Engineers (Corps) and the U.S. Environmental Protection Agency (EPA). The Washington State Department of Ecology (Ecology) concurs with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

The selected remedy is the only response action planned for the Site. This action addresses all contaminated media at the Site, and consists of the following actions:

- Landfill debris located in the intertidal zone of Clam Bay will be excavated to the extent necessary to establish a stable shoreline protection system, with a goal of no net loss of aquatic habitat. Excavated material will be placed, to the extent possible, on the upland landfill area prior to capping. Debris that is unsuitable for placement on the landfill will be tested for waste designation purposes and disposed of in an appropriate off-site landfill.
- The shoreline excavation backfill will be designed to achieve seep cleanup levels, provide the best possible habitat for marine organisms, and maximize long-term beach stability. Seeps associated with discharge from the landfill after implementation of the remedial action, if observed, will be monitored for compliance with seep discharge cleanup levels. Additional remedial measures will be implemented, as necessary, if seep discharge cleanup levels are not achieved.
- A thin cap of clean sediment will be established over intertidal Clam Bay sediment areas which exceed cleanup levels (roughly 5 acres). The overall goal is to reduce contaminant concentrations in surficial sediments sufficiently to assure that sediment dwelling organisms are adequately protected to support unrestricted use of the cap area within several years of completion of the remedial action. Clam Bay sediment and shellfish tissue will be monitored in intertidal areas currently exceeding the PCB cleanup goal for sediments (40 ug/kg [dry]) until compliance with cleanup goals is established, or until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting, whichever comes first.
- The upland portion of the landfill will be capped in accordance with the State of Washington's Minimum Functional Standards (MFS) for solid waste landfill closures. A hydraulic cutoff system will be installed upgradient of the landfill area. After completion of upland construction, the area will be revegetated, consistent with long-term O&M requirements and site development plans. A post-closure plan for the landfill cap, hydraulic cutoff system, and shoreline protection system will be developed during remedial construction and implemented following construction.

- Dioxin-contaminated debris will be removed from the main simulator complex in the Fire Training Area and disposed of in a RCRA hazardous waste landfill. If routes of potential leakage are found in the simulator floors, soils beneath the simulators will be sampled and analyzed for dioxins. If dioxin concentrations above cleanup levels are detected, the simulator(s) will be demolished, and the underlying contaminated soils excavated.
- Near-surface soils adjacent to the main simulator complex and the soil/debris pile north of the main complex will be sampled and analyzed for dioxins. Soil and debris with concentrations above cleanup levels will be excavated, tested for waste designation purposes, and disposed of in appropriate off-site landfills.
- Concrete USTs remaining in the Fire Training Area will be closed in-place following state UST closure requirements. UST piping systems, and TPH impacted soil excavated incidentally along with the piping, will be disposed of in an appropriate off-site landfill.
- The following institutional controls will be implemented:
 - ▶ Deed covenants to provide for the long-term protection and maintenance of the selected remedy;
 - ▶ A restriction on subsistence-level harvesting of shellfish until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting; and
 - ▶ An institutional control plan to address TPH-impacted soil left in-place in the Fire Training Area.

Statutory Determinations

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies to the extent practicable. However, because treatment of the principal threat at the site was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. Because this remedy may result in hazardous substances remaining on site above health-based levels, reviews will be conducted at 5-year intervals, at a minimum, or as required based on the performance evaluation criteria contained herein, to ensure that the remedy continues to provide adequate protection of human health and the environment.

Signature sheet for the foregoing Manchester Annex Record of Decision between the Department of the Army and U.S. Environmental Protection Agency.

Signature sheet for the foregoing Manchester Annex Record of Decision between the Department of the Army and U.S. Environmental Protection Agency.

DECISION SUMMARY

1.0 OVERVIEW

This Decision Summary provides a description of the site-specific factors and analyses that led to selection of the remedy for the Old Navy Dump/Manchester Annex Superfund Site (Site). It includes information about the Site background, the nature and extent of contamination, the assessment of human health and environmental risks, and the identification and evaluation of remedial alternatives.

The Decision Summary also describes the involvement of the public throughout the process, along with the environmental programs and regulations that may relate to or affect the alternatives. The Decision Summary concludes with a description of the remedy selected in this Record of Decision (ROD), and a discussion of how the selected remedy meets the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Documents supporting this Decision Summary are included in the Administrative Record for the Site. Key documents include the Final Remedial Investigation/Feasibility Study (RI/FS) and the Proposed Plan for Site Cleanup.

2.0 SITE LOCATION AND DESCRIPTION

The Site is located approximately 1 mile north of Manchester, Washington, in Kitsap County (Figure 1). The 40-acre site is situated on the western shore of Clam Bay, an embayment off the west side of Rich Passage in Puget Sound (Figure 2). Clam Bay is typical of shallow sand-mud marine communities in Puget Sound, and supports a variety of marine resources. Commercial and experimental salmon farms also operate in the Bay.

The Site was historically owned and operated by the U.S. Navy for submarine net maintenance, fire training, and waste disposal activities. Current Site owners include the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA); both of which operate laboratory facilities at the Site. Approximately 100 personnel work at the two laboratory facilities. Washington State Parks operates Manchester State Park, a seasonal park facility, on the extreme western portion of the Site.

The EPA Manchester Laboratory is situated in the northern 17.5 acres of the Site. The northernmost 5 acres of the EPA property includes the EPA laboratory and associated concrete parking pad and other facilities, and is also the location of the former Navy Net Depot. The remaining 12.5 acres, located in the central portion of the Site, contains a landfill area. A small portion of the northwestern corner of the landfill area extends onto Manchester State Park property.

The southern 22.5 acres of the Site was the location of a former Navy Fire Training School and is currently occupied by the NOAA National Marine Fisheries Service (NMFS). The U.S. Naval Fuel Supply Center is located south of the Site.

The Site is relatively flat, sloping to the east at roughly a 1 percent grade. Apart from the concrete parking pad in the north and the existing EPA and NMFS buildings, most of the Site's surface is vegetated with grasses, shrubs, and bushes. A localized wetland area exists at the southern end of the landfill, and an emerging wetland area may exist on the landfill itself. Along the northwestern portions of the NOAA property, and west and north of the Site in general, the terrain becomes hilly and forested.

Listed and candidate threatened and endangered species identified at the Site include the great blue heron, bald eagle, and Steller's sea lion. No archeological or historical resources have been identified at the Site. However, according to the Cultural Resources Reconnaissance report prepared for the Site, there is a moderate probability for hunter-fisher-gatherer cultural deposits.

3.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Site was originally established as part of a 385-acre military reservation in 1898, and subsequently transferred from the War Department to the Navy in 1919. During World War II, the Net Depot and Fire Fighting School were established at the Site. These activities, and the landfill disposal history, are summarized below.

- Net Depot. From approximately 1940 to the early 1950s, the Manchester Net Depot functioned to construct, repair, and store submarine nets, made of steel cable and suspended from gate vessels across strategically important waterways such as Rich Passage, which guards the Puget Sound Naval Shipyard at Bremerton. The Net Depot was comprised of a large concrete pad and various structures including storage facilities and a paint and sandblasting building. Activities performed within this area of the Site included net and buoy maintenance,

sandblasting, painting, and machining operations. The Net Depot appears to have been disestablished in the early 1950s, when the area became devoted to boat storage.

- Fire Training Area. Formally established in 1942, the initial purpose of the Fire Fighting School was to train World War II Navy personnel to extinguish ship fires. The school included a number of features which enabled typical ship fires to be set and extinguished, such as ship compartment simulators, "Christmas trees," and "smothering tanks." Christmas trees and smothering tanks typically consisted of small, bermed concrete pads with metal superstructures for igniting waste oil for fire-training activities. Associated equipment included underground storage tanks (USTs) for gas, diesel, and waste oil; fuel lines; water lines; and pumps. Although the Fire Fighting School was formally disestablished immediately following World War II, its use may have continued during the 1950s and possibly also during the early 1970s. Three steel USTs were removed in 1994; however, at least five concrete USTs and several concrete simulators remain in this area.
- Landfill Area. Between approximately 1946 and 1962, the Navy filled the tidal lagoon between the Net Depot and Fire Training Area. The majority of the landfiling appears to have occurred between 1946 and 1955. The bulk of the waste included building demolition debris and burnable garbage from the Puget Sound Naval Station, along with scrap metals, steel, old submarine nets, and other debris. The resulting landfill, which has an average thickness of 6 feet and covers about 6 acres, was subsequently covered with a 1-foot thickness of sand and gravel. The southeastern edge of the landfill (approximately 1,200 feet in length) is currently exposed along the Clam Bay shoreline, and landfill waste materials have eroded into the adjacent intertidal area.

The Navy surplused 150 acres of the Station (the former Naval Station property other than the fuel depot) to the General Services Administration (GSA) in 1960, though Navy use reportedly continued to about 1962. In 1967, GSA transferred the Net Depot and most of the Landfill Area to the Public Health Service, and the property subsequently fell under EPA control. The Fire Training Area was transferred in 1968 to the U.S. Fish and Wildlife Service (USFWS), and is now under the administration of the NOAA/NMFS. The portion of the Station located north and northwest of the EPA and NMFS properties, including a small portion of the Landfill Area, was transferred to the State of Washington in 1970, becoming Manchester State Park.

Several investigations including preliminary assessments, site investigations, and a UST removal and closure action were performed by the U.S. Army Corps of Engineers (Corps), EPA, and NOAA during the period from 1987 to 1994. Based on the findings of these investigations, the Manchester Annex Site was listed in 1994 on the CERCLA (Superfund) National Priorities List (NPL) of Hazardous Sites. Since historical Department of Defense (DoD) operations appear to be the sole cause of the contamination present at the Site, CERCLA activities are being conducted under the Formerly Used Defense Site (FUDS) program. Cleanup costs will be paid from a special fund set aside for properties formerly used by DoD.

The RI/FS for the Manchester Annex Site, completed in December 1996, was conducted by the Corps with oversight by EPA pursuant to the interagency Agreement (IAG).

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

Sections 113(k)(2)(b) and 117(a) of CERCLA set forth minimum requirements for public participation at sites listed on the NPL. The Corps and EPA have met these requirements and maintained an active community relations program at the Site.

The Community Relations Plan for the Site is presented in the RI/FS Project Management Plan, available for review in the information repositories (see below). The Corps and EPA developed this Plan from discussions with state and federal agencies, elected officials, community residents, and business and interest group representatives. These interviews helped identify community concerns and interests about the Site, and helped define the best ways to work with the community during the investigation and cleanup.

Community participation has been promoted through the following activities:

- A briefing for laboratory employees who work at the Site, prior to beginning the RI/FS;
- Creation of the Manchester Annex Work Group, an advisory group consisting of representatives from the Corps, EPA, the Washington State Department of Ecology (Ecology), local, state, and federal government, tribal government, interest groups, and the general public. The Work Group met approximately quarterly during the RI/FS investigation. Issues raised at these meetings helped identify community concerns and issues throughout the investigation process;

- Issuance of project Fact Sheets and invitation to participate in the Manchester Annex Work Group meetings.

The actions taken to satisfy the requirements of the federal law have also provided a forum for citizen involvement and input to the remedial action decision.

Project documents have been available for public review at the following locations:

Manchester Public Library
8067 East Main Street
Manchester, Washington

U.S. Army Corps of Engineers
Seattle District Office
4735 East Marginal Way South
Seattle, Washington

The Administrative Record is on file at the following locations:

EPA Lab
7411 Beach Drive East
Port Orchard, Washington

U.S. Army Corps of Engineers
Seattle District Office
4735 East Marginal Way South
Seattle, Washington

The decision is based on the Administrative Record for this Site.

Notice of the availability of the Proposed Plan, plus notice of a public meeting and public comment period on the Proposed Plan, was published in local newspapers. The Proposed Plan, was mailed to interested parties on April 1, 1997. The public comment period lasted from April 2 to May 2, 1997. An employee briefing of EPA, Ecology, and NMFS laboratory staff on the preferred remedy was held at the Site on March 31, 1997, and a public meeting held on April 16, 1997, to answer questions and receive public comment.

In total, 54 comments were received by the Corps concerning the Proposed Plan. The comments are summarized and responses presented in the Responsiveness Summary (Attachment A) of this document.

5.0 SCOPE AND ROLE OF RESPONSE ACTION

The selected Remedial Action described in Section 11 of this ROD is intended to address potential current and future impacts to human health and the environment resulting from chemical contamination at the Site. The greatest Site risks are associated with potential skin contact and incidental ingestion of waste materials containing elevated metals and dioxin/furan concentrations. High concentrations of these compounds are found in the former landfill waste materials, simulator debris, and associated soils. There is also a threat of contaminants, primarily metals and PCBs, migrating from the landfill area into Clam Bay, where sediments and marine organisms may accumulate contaminants. The purpose of this response action is to minimize future exposure to contaminated materials, and to reduce contaminant migration into Clam Bay.

Environmental response actions, completed prior to this remedy selection process, have occurred in the Landfill and Fire Training Areas of the Site. The Navy placed a 1-foot-thick soil cap over the landfill in the late 1950s/early 1960s, to minimize direct contact with landfill wastes. Several steel USTs were removed from the Fire Training Area in 1993 under the direction of the Corps, along with limited excavation of petroleum-impacted soil.

The remedy described herein is the final response action planned for this Site.

6.0 SUMMARY OF SITE CHARACTERISTICS

This section summarizes information obtained during the RI/FS and previous site investigations, including sources of contaminants, contaminants of concern, impacted media, and potential routes of human and environmental exposure.

The validated data from the RI, along with data collected and validated from prior investigations, were screened relative to area background or local reference conditions and conservative risk-based screening

criteria to identify chemicals of potential concern (COPCs) at the Site. Risk-based criteria used to screen the sampling data included:

- Model Toxics Control Act (MTCA) cleanup levels for soil, groundwater, and surface water (Chapter 173-340 WAC);
- State surface water quality standards (Chapter 173-201 A WAC) and federal Clean Water Act criteria (40 CFR 131, the National Toxics Rules);
- EPA Region 3 Screening Levels for soil, water, and fish/shellfish tissue (Smith, 1995);
- Plant and wildlife protection screening values for soils obtained from Will and Suter (1994) and Oak Ridge National Laboratory (1994); and
- Washington State Department of Ecology (Ecology) Sediment Management Standards (Chapter 173-204 WAC).

Risk-based screening levels incorporate conservative assumptions for protection of human health (e.g., one-in-a-million excess cancer risk, hazard quotient of one, residential and subsistence fisher exposure scenarios) and the environment (e.g., no or low adverse effects levels, generally chronic exposure scenarios, no mixing zone).

Analytes that exceeded the screening levels in any media were identified as COPCs at the Site. The COPCs identified at the Site include metals, PCBs, chlorinated pesticides, dioxins and furans, polynuclear aromatic hydrocarbons (PAHs), and petroleum hydrocarbons. A complete listing of the COPCs identified through the preliminary risk screening process is presented in Table 1.

Tables 2 through 11 summarize soil, groundwater, surface water, sediment, and tissue quality data collected at the Site, including data on the number of samples analyzed, their detection frequency and maximum detection, as well as exceedence frequency of screening levels. Tables 2 through 4 summarize soil quality data for the three source areas (Landfill, Fire Training, and Net Depot) identified at the Site. Tables 5 and 6 summarize groundwater quality data for the former Landfill Area (Surficial Fill unit) and the water supply aquifer (Outwash Channel Aquifer) near the former Fire Training Area, respectively. Tables 7 through 9 summarize surface water and seep discharge quality data for the three source areas of the Site, and Tables 10 and 11 summarize sediment and tissue quality data for Clam Bay.

A further evaluation of COPCs was performed as part of the risk assessment to identify the primary chemicals or chemical grouping posing a potential risk to human health and the environment. This evaluation included eliminating COPCs which were below naturally occurring background concentrations (e.g., certain metals). The baseline risk assessment (discussed below) identified the following twelve primary chemicals or chemical groupings at the site (out of the initial list of COPCs) associated with one or more media (soil, sediment, groundwater, surface water, and tissue) at concentrations which exceed risk-based remediation goals or criteria:

Inorganics	Organics
- Arsenic	- Polychlorinated biphenyls (total PCBs)
- Asbestos	- Polychlorinated dibenzo-p-dioxins and dibenzofurans (dioxins/furans)
- Cadmium	- 2,4-Dimethylphenol
- Copper	- Vinyl chloride
- Lead	
- Nickel	
- Silver	
- Zinc	

Maximum concentrations for these twelve chemicals or chemical groupings detected in each Site medium are summarized in Table 12. Total Petroleum Hydrocarbon (TPH) concentrations are also included in Table 12. While only posing marginal risk at the Site, TPH concentrations in soils at the Site exceed State of Washington Model Toxics Control Act (MTCA) soil cleanup goals.

For ease of discussion, the major findings of the RI/FS are presented for each of the following source areas, consistent with the Navy's historical Site use activities:

- Landfill and Clam Bay Sediments;
- Fire Training Area; and
- Net Depot and Manchester State Park.

Figure 2 illustrates the location of these areas and other major Site features.

6.1 Landfill and Clam Bay Sediments

The landfill encompasses an area of approximately 6 acres, with the majority of the debris in the uplands area and the eastern portion extending into the Clam Bay intertidal zone. The physical boundary of the landfill has been delineated by test pit observations of buried debris. The thickness of the upland landfill debris generally averages about 6 feet with some portions of the landfill ranging to 12 feet in thickness. Figure 3 presents a generalized geologic cross section through the Landfill (refer to Figure 2 for the cross section location). The upland debris is covered by a cap of clean sand and gravel which averages one foot in thickness. The intertidal landfill debris is exposed in a narrow strip along the shoreline, about 20 to 50 feet wide and ranging from 1 up to 8 feet thick. The total volume of the landfill debris (upland and intertidal) and cap material is approximately 70,000 cubic yards.

As shown on Figure 3, the landfill debris is underlain by a thin layer of surficial fill and beach deposits overlying a thick sequence of low permeability silt. A localized zone of saturation occurs within the landfill debris and surficial fill unit, associated with local precipitation recharge, surface water run-on to the landfill area, and tidal flushing. The low permeability silt acts as a natural barrier, preventing the downward movement of landfill leachate to the deeper groundwater zone. Recharge to the landfill ultimately mixes with leachate in the landfill and discharges as seeps along the intertidal zone.

Landfill wastes contain elevated concentrations of a variety of metal and organic chemicals including arsenic, cadmium, copper, lead, nickel, silver, zinc, PCBs, dioxins/furans, vinyl chloride, and asbestos, as shown in Table 2. Roughly half of the landfill soil samples analyzed by toxicity characteristic leaching procedure (TCLP) exceeded lead toxicity criteria. Erosion of landfill waste materials in the intertidal area of Clam Bay, due to tidal action, represents a continuing source of contaminants, primarily metals, PCBs, and dioxins/furans, to the marine environment.

The highest concentrations of chemicals of concern in the sediments and shellfish tissue, particularly metals and PCBs, were identified in areas immediately adjacent to the landfill toe. Constituent concentrations decline rapidly outside the landfill toe area. PCBs, metals (cadmium, copper, lead, mercury, and zinc), and dioxins were the primary chemicals identified in marine sediments (Table 10). Chemical analysis of marine tissue, including clams, geoduck, and sea cucumbers, were also performed. Tissue concentrations in Clam Bay were above reference site-adjusted screening levels for PCBs, dioxins, metals, and PAHs (Table 11).

Potential impacts to marine organisms were evaluated by performing laboratory bioassay tests using contaminated sediments collected at the Site. The bioassay results indicated moderate adverse effects to the existing benthic infauna within the intertidal area of Clam Bay.

Impacts to sediment quality within Clam Bay are largely limited to the uppermost layer of sediments. Two high-resolution coring profiles of PCBs indicate that the depth of contamination ranges from 0.3 to 0.7 foot, averaging 0.5 foot. A deeper accumulation of contaminated sediments exists in an isolated area of the intertidal zone. Offshore from the north end of the landfill (just south of the pier) is a localized (approximately 2,700-square-foot) depression with a thick (greater than 3-foot) accumulation of fine-grained sediment exhibiting elevated concentrations of PCBs, copper, zinc, and 2,4-dimethylphenol. This offshore feature (referred to as the "silt basin") may have resulted from removal of an in-water structure, or from local current movement and sediment deposition patterns.

Seep discharges along the landfill toe, associated with surface water and precipitation recharge through the landfill as well as tidal flushing, result in the release of dissolved metals to the nearshore environment. The discharge to Clam Bay is fairly low, estimated to be in the range of 5 to 8 gallons per minute across approximately 800 feet of landfill shoreline frontage. Saturated conditions within the surficial fill and beach deposits beneath the landfill debris largely result from the local freshwater recharge and tidal inflow. Groundwater flow directions within the surficial fill unit is shown on Figure 4. The "groundwater" quality in this unit, summarized in Table 5, is indicative of leachate conditions beneath the landfill. Leachability tests (TCLP) of landfill debris samples indicated that metals within the debris are leachable and likely dissolve into recharge water infiltrating through the waste. Several metals (including copper, nickel, silver, and zinc) and low-level PCB concentrations (Table 7) were detected in tidal seeps discharging from the landfill. The seeps contain a component of non-saline groundwater and a component of seawater which, at high tide, flows into the beach deposits which underlie the landfill debris, backflushing out at low tide.

6.2 Fire Training Area

Historical activities at the Fire Training Area included fuel storage and firefighting training. The Fire Training Area previously included three simulator structures, only one of which (referred to as the "main simulator complex") is still standing. Accumulations of debris inside the main simulator complex contain elevated concentrations of dioxins/furans. The internal debris volume is estimated at approximately 200

cubic yards. Table 3 summarizes soil quality data for the Fire Training Area.

Significantly lower concentrations of dioxins/furans were also detected in the following media/locations outside the simulators:

- Surficial Soil in the immediate Vicinity of the Simulators. The presence to dioxins/furans is likely associated with the fallout of ash or burning debris from the main simulator during training exercises. The depth of contamination appears to be less than one foot and is limited to several isolated areas near the corners of the simulator structures, as shown on Figure 8. Dioxin releases are not likely to have extended under the simulator structures, except through any possible floor cracks, if they exist. No sampling and analysis have been performed to verify this condition.
- Pile of Demolition Debris and Soil Located about 500 Feet North of the Main Simulator Complex. The demolition debris is associated with the former northern simulator at this location. The simulator rubble pile (Figure 8) has an estimated volume of approximately 120 cubic yards.

Soils in the vicinity of the main simulator complex also exhibit concentrations of total petroleum hydrocarbons (TPH), with concentration of up to 15,000 mg/kg as diesel and 7,700 mg/kg as oil. The TPH consists of a mixture of weathered diesel- and oil-range hydrocarbons. A number of petroleum-containing USTs were formerly located in this area, and several are known to have leaked. In addition, at least five concrete USTs still remain in-place. The remaining concrete USTs contain residual sludges. Chemical analysis of these sludges during the tank removal process, prior to the RI, indicated the presence of PCBs. The vertical extent of TPH-impacted soils ranged from near-surface to as much as 10 feet below grade.

Smaller areas of TPH concentrations were detected at four former fire training stations (i.e., smoldering pots and "Christmas trees") north of the main simulator complex, shown on Figure 8. These areas contained diesel- and oil-range hydrocarbons which permeated the upper several feet of soil. In addition, soil at the location of a former gasoline UST contained subsurface hydrocarbon concentrations in the gasoline range of up to 480 mg/kg.

The TPH-impacted soils within the former Fire Training Area are located near the Outwash Aquifer which is used by the adjoining Manchester Naval Fuel Depot and a local community for potable water supply. The general location and groundwater flow direction within the Outwash Aquifer is shown on Figure 4. The remedial investigation included extensive data collection and testing to evaluate the potential impact of the TPH on the Outwash Aquifer. Initial efforts included chemical analysis and leachability testing of TPH-impacted soils using the Synthetic Precipitation Leaching Procedure (SPLP). The empirical TPH soil-to-water partitioning ratios at the site range from 1,000:1 to 7,000:1, and average 5,000:1 (Table 13). These results indicate that the TPH is highly weathered, due to chemical and biological degradation over a 30-year-plus period since release, and largely consists of the heavy (very low aqueous solubility) petroleum fraction. The SPLP data indicate that the remaining petroleum constituents are not leachable. This conclusion is supported by shallow aquifer monitoring results, which were generally below screening levels for petroleum constituents. A summary of the groundwater quality in the Fire Training Area is presented in Table 5.

In addition, several pumping tests, using the Navy's water supply wells, were conducted to assess whether pumping the water supply wells would result in the transport of petroleum constituents to the aquifer. Sampling of shallow groundwater beneath the TPH-impacted soils during active pumping did not identify any petroleum constituents, even at very low level detection limits. Consequently, the TPH-impacted soils do not pose a risk to nearby public and private water supply wells.

Diesel-range hydrocarbons were detected at a concentration of 5.2 mg/L (and 20 mg/L in a duplicate sample) in one surface water sample collected from the outflow of a pipe discharging to a pond in the southern portion of the Fire Training Area. Based on a review of historical site plans, the pipe appears to be connected to a storm drain system and likely received TPH in runoff from roadways or parking lots at the NMFS lab. However, the exact source area of this pipe has not been determined.

6.3 Net Depot and Manchester State Park

Tables 4 and 9 summarize soil and seep discharge quality data for the Net Depot area. The analytical results for the Net Depot and Manchester State Park areas of the Site indicated limited exceedence of conservative risk-based screening criteria. Several metals with concentrations slightly elevated above the screening levels were detected in these areas, including arsenic (8.6 mg/kg), beryllium (0.8 mg/kg), copper (71 mg/kg), and zinc (231 mg/kg). Several surface water/seep samples in the Net Depot area also exceeded screening levels for dissolved copper (30.6 ug/L) and total cyanide (5 ug/L). These seeps appear to be associated with drain pipes which may receive storm water runoff from the parking lot areas.

7.0 SUMMARY OF SITE RISKS

CERCLA response actions at the Site, as described in the ROD, are intended to protect human health and the environment from current and potential future exposure to hazardous substances detected at the Site.

Baseline human health and ecological risk assessments were performed to assess Site conditions and to determine the need for cleanup. As set forth in the NCP, the risk assessment provides an understanding of the actual and potential risks to human health and the environment at the Site, in the absence of any future actions to control or mitigate these releases.

7.1 Human Health Risks

Detailed assessments of the risks to human health involve a five-step process: 1) identification of chemicals of potential concern; 2) determination of exposure to the population(s) at risk; 3) assessment of contaminant toxicity; 4) quantitative characterization of site risk; and 5) evaluation of uncertainties associated with the overall risk assessment.

7.1.1 Chemicals of Potential Concern

The risk assessment evaluated chemicals detected in at least one sample at a concentration above the most conservative risk-based screening levels. These COPCs included seventeen metals and inorganics, ten hydrocarbons, four pesticides, PCBs, dioxin/furan congeners, and several miscellaneous organic chemicals. A listing of COPCs detected at the Site is presented in Table 1.

7.1.2 Exposure Assessment

The exposure assessment characterizes exposure scenarios, identifies potentially exposed populations along with pathways and routes of exposure, and quantifies contaminant exposure in terms of a chronic daily dose (i.e., milligrams of contaminant taken into the body per kilogram of body weight per day).

Consistent with recent EPA guidance, human health exposure scenarios evaluated in the risk assessment were developed based on reasonable assumptions about future land uses and human activities expected at the Site. Most of the Site is currently used by EPA and NMFS as an environmental laboratory facility. In addition, a small portion of the Site is used as a State Park. Based on input from the Manchester Annex Work Group, continued use of the Site for federal laboratories and a State Park was assumed in evaluating potential human health risks. Assuming future residential use at the Manchester Annex Site was considered unrealistic.

The conceptual model for chemical release, transport, and human exposure at the Site is presented on Figure 5, and exposure pathways are illustrated on Figure 6. Mechanisms for chemical release and exposure at the Site include the following:

- Direct contact with contaminated soils, sediments, and debris;
- Volatilization, dust emission, and inhalation of chemicals from contaminated surface soil;
- Solubilization, transport, and drinking water consumption of chemicals in groundwater;
- Surface water runoff and tidal erosion of surface soils and sediments into waterways; and
- Transport of contaminants to Clam Bay, bioconcentration and bioaccumulation through the food chain, followed by recreational or subsistence-level consumption of contaminated seafood.

EPA Superfund guidance recommends that reasonable maximum exposures be calculated in site risk assessments. Reasonable maximum exposure estimates are calculated using assumptions that result in higher than average exposures to ensure that the risk assessment results are protective of the reasonably maximum exposed individual. For this risk assessment, both average and reasonable maximum exposures (RME) were estimated using default exposure factors and calculation procedures described in EPA Region 10 risk assessment guidance. Average and upper 95th percent confidence limits (UCLs) of the arithmetic mean chemical concentrations detected at the Site were used to calculate the concentration terms used in the exposure assessment. If the estimated UCL exceeded the maximum detected concentration, the estimate defaulted to the maximum detected concentration.

An individual's exposure to chemicals through activities such as digging in the soil, or eating shellfish caught at the Site, was estimated assuming that current controls such as the existing landfill soil cover are not maintained into the future.

Currently, EPA prohibits shellfishing on its beaches, and staff working at the EPA and NMFS facilities presently obtain six or fewer meals per year from Clam Bay. This condition is partially the result of the relatively low edible clam biomass at the Site resulting from habitat limitations. However, on-site recreational and tribal subsistence harvesting of seafood within Clam Bay could increase in the future through habitat enhancement. Following the recommendations of the Washington State Department of Fish and Wildlife (WDFW) and the Suquamish Tribe, the risk assessment evaluated recreational and subsistence harvesting rates possible under a future habitat enhancement scenario. Reasonable maximum harvesting rates assumed in the exposure assessment were 22 meals (3.4 kilograms [kg]) per year and 150 meals (23 kg) per year for recreational and subsistence consumption, respectively.

7.1.3 Toxicity Assessment

Toxicity and risk assessments vary for different chemicals depending upon whether carcinogenic and non-carcinogenic risks are being evaluated. The toxicity criteria used in risk assessments are based on the endpoints observed from laboratory or epidemiological studies with the chemicals. Carcinogenic risks are calculated using toxicity factors known as cancer potency factors (CPFs), while non-carcinogenic risks rely on reference doses (RfDs). When available, toxicity factors used in this risk assessment were obtained from EPA's Integrated Risk Information System (IRIS; EPA, 1995a). In the absence of verified toxicity factors on IRIS, other EPA sources were consulted (Dollarhide, 1992; and EPA, 1985, 1989, 1993, and 1995b).

Reference Doses (RfDs). Reference doses are used to quantitatively evaluate non-carcinogenic toxicity of a specific chemical. Reference doses are established by EPA at concentrations below which adverse health effects are not known to occur. In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

Cancer Potency Factors (CPFs). The toxicity of potential human carcinogens are evaluated differently by EPA. It is assumed for carcinogens that no threshold concentrations exist below which adverse effects may not occur. Probabilistic methods based on chemical-specific dose-response curves are used to establish slope factors, which are then used to quantify potential risks from exposure to carcinogens. Although dose-response curves are generated by EPA using human data when those data are available, dose-response curves are often generated in laboratory studies using high chemical concentrations. The dose-response curve is fitted to a linearized multi-stage model that extrapolates the slope of the curve from high experimental concentrations to low concentrations at which people are typically exposed. The final CPF is based on the upper 95th percentile UCL of the extrapolated slope of the dose-response curve.

Inorganic Lead. The methods used to assess exposure, toxicity, and risk are different for inorganic lead than for other contaminants. A great deal of information on the health effects of lead has been obtained through decades of medical observation and scientific research. Some of the effects resulting from exposure to inorganic lead compounds are associated with increased blood lead. However, these effects may occur at blood lead levels so low as to be essentially without a threshold. Currently, EPA has considered it inappropriate to develop either an RfD or CPF for inorganic lead.

EPA has developed and is using an Integrated Exposure Uptake Biokinetic model of lead exposures which has been used in lieu of verified RfD and CPF criteria. The model has been applied primarily to residential sites, though limited applications have been developed for non-residential areas were considered in this risk assessment. Consistent with model results and state and federal cleanup guidelines, soil lead concentrations below 1,000 milligrams per kilogram (mg/kg) were considered protective in non-residential areas. This value was used as a risk-based soil concentration benchmark criterion for assessing elevated lead concentrations detected in soil at the site. Lead concentrations of up to 56,000 mg/kg have been detected within the Landfill Area of the Site (Table 2).

TPH. Elevated total petroleum hydrocarbon (TPH) concentrations up to 15,000 mg/kg have been detected in the Fire Training Area of the Site (Table 3). However, no verified oral toxicity factors have been derived for TPH mixtures. EPA has developed provisional oral RfDs and CPFs for several TPH mixtures including gasoline and diesel fuels based on extrapolations of inhalation toxicity, since few other data were available. In making this provisional determination, EPA applied conservative uncertainty factors to address some of the possible bias associated with route-to-route extrapolations. The provisional TPH toxicity criteria used in this risk assessment are currently under EPA review.

7.1.4 Risk Characterization

For risk characterization purposes, the entire Site was considered in aggregate, utilizing UCL exposure point concentrations within different areas of the Site to derive Site-wide RMEs and risks. For cleanup alternative evaluation purposes, the Site was divided into three different remedial action areas characterized by different waste characteristics and response actions (see Figure 2 and Section 9.0 below).

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to specific COPCs. Cancer potency factors are multiplied by the estimated intake (exposure) of a potential carcinogen to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The EPA's current guideline for determining whether the reasonable maximum cancer risk estimated for a given hazardous site exceeds "threshold" cleanup action levels is 10^{-4} (1 in 10,000 probability of developing cancer resulting from lifetime exposure to a carcinogen). By comparison, the general target for lifetime cancer risks under MTCA is 10^{-5} . Under both programs, however, a cancer risk goal of 10^{-6} is generally used where practicable.

Non-carcinogenic risk is evaluated by dividing the daily dose resulting from site exposure by the estimate of acceptable intake (or reference dose) for chronic exposure. If the ratio between these values (termed the hazard quotient) is less than 1, then the exposure does not exceed the protective level for that particular chemical. Conversely, hazard quotient values greater than 1 indicate a potential risk to human health. Under both the CERCLA and MTCA programs, if the sum of all chemicals' hazard quotients for an exposure medium (termed the hazard index) is greater than 1.0, then there may also be a concern for potential health effects.

Potential health risks to individuals under the following scenarios were evaluated:

- An on-site worker;
- A subsistence consumer of shellfish; and
- An occasional site visitor (including children).

Both the on-site worker and occasional site visitor (child) had similarly high calculated health risks, though the visitor scenario had slightly higher risk estimates. Calculated average and reasonable maximum exposure cumulative cancer risks and hazard indices for the three different exposure scenarios are summarized in Table 14. Under RME conditions, a cumulative Hazard Index of 1,000 and a total cumulative lifetime cancer risk of 1×10^{-3} were calculated based on the summation of all chemicals and potential pathways at the Site. Calculated health risks to the on-site worker and occasional site visitor are primarily associated with potential skin contact and incidental ingestion of waste materials containing elevated metal and dioxin/furan concentrations. High concentrations of these compounds are restricted to subsurface landfill waste materials and simulator debris. In addition, lead concentrations detected within the landfill areas exceeded the risk-based benchmark concentration for non-residential sites of 1,000 mg/kg. Based on the risk assessment, soil containing elevated TPH concentrations was not identified as a threat to human health.

Potential health risks for the subsistence consumer of shellfish, while lower, were still above concentrations targeted by the State of Washington cleanup program (MTCA; Table 14). Health risks to the subsistence consumer of shellfish primarily result from consumption of PCBs in shellfish collected from the intertidal area of Clam Bay.

7.1.5 Uncertainty in the Human Health Risk Assessment

The overall uncertainty in the human health risk characterization is represented in part by the differences between the average and reasonable maximum risk estimates presented in Table 14. A semi-quantitative sensitivity analysis was performed to identify individual exposure and toxicity assessment assumptions which contributed most to the overall uncertainty in the risk estimates. The sensitivity analysis identified five principal areas of uncertainty:

- Representativeness of key soil exposure concentration terms;
- Dermal (skin contact) exposure assumptions and extrapolations;
- Possible access to the Site by an occasional site visitor;
- Toxicity assessment of PCB congeners; and
- Risk characterization using cancer risk models.

Most assumptions incorporated into the baseline risk assessment were intentionally conservative so that the risk assessment would be more likely to overestimate rather than to underestimate risk. However, in some cases the nature of the uncertainty is such that the impact of the assumptions could result in an overestimate or underestimate of Site risk.

7.2 Ecological Risks

An ecological risk assessment was performed to characterize current and potential future environmental threats at the Site, particularly to valuable ecological resources such as Clam Bay habitats. The assessment which addressed both aquatic and terrestrial exposures, incorporated a two-tiered approach. In the Tier I assessment concentrations of chemicals of potential concern were compared to toxicological benchmarks which represent concentrations of chemicals in environmental media (i.e., soil, water, sediment, and biota) that are presumed to be non-hazardous to the surrounding biota. Tier I relied on chemical concentration

measurements and conservative toxicity benchmark criteria available in the literature. Based on Tier I results, the need for and scope of more definitive Tier II biological evaluations were determined. Tier II incorporated Site-specific information as appropriate, and included biological sampling to support or refute the Tier I findings.

The ecological assessment identified metals, PCBs, and furans in the Landfill Area which have the potential to impair microbial and soil processes, inhibit plant growth, and/or could result in toxicity to earthworms and sensitive small rodents which inhabit the Site. Several of these metals are also currently discharging from the landfill shoreline area at concentrations which could result in acute and/or chronic toxicity to sensitive marine life. Because of tidal currents and associated mixing processes, the extent of elevated metal concentrations within the shoreline area of Clam Bay is likely limited to the immediate vicinity of the seepage face and seepage channels.

Metals, PCBs, and 2,4-dimethylphenol were detected in intertidal sediments of Clam Bay at concentrations which could result in toxicity to sensitive marine infauna. Confirmatory sediment bioassays generally confirmed this condition. Further, elevated metals, PCB, and furan concentrations detected in intertidal shellfish could pose a risk to wildlife which derive their entire diet from prey obtained from Clam Bay. Overall, potential risks to the environment at the Site are limited to the Landfill Area and to the intertidal area of Clam Bay.

Detection limits for mercury, PCBs, DDT, aldrin, and dioxins in seeps were not sufficient to evaluate risk to marine aquatic life. However, these chemicals were incorporated in the ecological risk assessment at one-half detection limit values. Some other chlorinated pesticides were also undetected at elevated detection limits, but were not incorporated in the risk assessment potentially causing a slight underestimate of the overall risk to aquatic life. Similarly, detection limits for several chlorobenzene compounds were not sufficient to compare with ecological sediment criteria. However, Tier II bioassay testing of Site sediments provided a direct measure of cumulative risk from all Site contaminants.

8.0 REMEDIAL ACTION OBJECTIVES

8.1 Need for Remedial Action

The results of the baseline human health and ecological risk assessments indicate that potential long-term risks associated with soil and debris in the Landfill and Fire Training Areas, and sediment contamination in Clam Bay, are above acceptable concentrations defined under both the state (MTCA) and federal (Superfund) regulations. Actual or threatened releases of hazardous substances from this Site, if not addressed by remedial actions, may represent a current or potential threat to public health, welfare, or the environment. Consistent with the NCP and EPA policy, remedial action is warranted to address these potential risks.

This Record of Decision makes a distinction between cleanup levels and cleanup goals. Cleanup levels represent specific concentration limits to protect human health and the environment, as defined by the Site-specific risk assessment and in applicable or relevant and appropriate regulations (ARARs). Table 15 presents a listing of Site-specific cleanup levels and cleanup goals. Remedial alternatives were developed for the Manchester Annex Site to attain these cleanup levels.

In contrast, cleanup goals are conceptual targets for additional Site-specific cleanup of two key contaminants: TPH and PCBs. The soil cleanup goal for diesel and oil-range TPH as defined by MTCA is 200 mg/kg. However, because of the low leachability and low risk associated with TPH at the site, attainment of this goal is not necessary to provide protection of human health and the environment. Nevertheless, where practicable, additional operations and maintenance controls may be appropriate to further reduce TPH-related risks.

Although sediment cleanup levels for the Manchester Annex Site were based on the existing recreational exposure condition, sediment and tissue cleanup goals for PCBs were developed assuming a possible long-term subsistence fishing use of Clam Bay (Table 15). Both sediment and shellfish concentrations are predicted to decline rapidly following remediation to the recreational-based cleanup levels. Risks associated with subsistence fishing can be controlled by implementing temporary limitations on subsistence-level consumption during the initial recovery period. In this case, monitoring would be performed to verify attainment of the cleanup goals.

8.2 Landfill Area and Clam Bay

The human health and ecological risk assessment identified potential threats associated with a variety of metal and organic chemicals detected within the Landfill Area. Based on the risk assessment the following remedial action objectives were developed for the Landfill and Clam Bay areas of the Site:

- Prevent human and wildlife contact with solid wastes and soils/sediments in the landfill;
- Prevent fugitive dust emissions containing asbestos;
- Prevent shoreline erosion of landfill wastes;
- Reduce solubilization and migration of landfill contaminants to Clam Bay by eliminating seeps or by improving the quality of the seeps so that they meet water quality criteria;
- Reduce concentrations of metals, PCBs, and 2,4-dimethylphenol to below cleanup levels for sediments in the biologically active zone (0 to 10 cm depth); and
- Prevent subsistence-level harvesting of shellfish in the nearshore areas of Clam Bay until the shellfish are determined to be safe to consume at a subsistence level.

Instead of establishing numerous chemical-specific cleanup levels for soils and solid wastes present within the upland and shoreline areas of the Site, the presumptive remedy for military landfills (capping) was first applied to the Site to determine if this presumptive remediation approach could achieve most or all of the identified remedial action objectives. The area to be contained within the cap was initially determined based on the physical extent of landfill debris. The extent of solid wastes at the Site is depicted on Figure 7.

To evaluate the protectiveness of the presumptive remedy applied to the Landfill Area, the residual risk associated with soils and sediments located immediately adjacent to the landfill area (i.e., outside the footprint of the presumed capping area) was calculated using methodologies equivalent to those used in the baseline risk assessment. The results of this assessment reveal that, even under RME conditions, risks to on-site workers, occasional site visitors, and terrestrial wildlife would be below both MTCA and CERCLA risk goals (i.e., cancer risks below 1×10^{-5} , Hazard Index below 1, and no identified risk to the upland environment). The presumptive remedy is therefore adequately protective of upland exposure conditions within the Landfill Area.

While the presumptive remedy of landfill capping would also achieve substantial risk reductions for existing or potential receptors in Clam Bay (i.e., aquatic life and subsistence fishers), this action may not be sufficient by itself to achieve all of the identified remedial action objectives within the marine environment. Accordingly, chemical-specific cleanup levels and cleanup goals were developed for aquatic exposure pathways which will achieve overall risk management goals as follows:

- A cumulative cancer risk goal under future RME conditions of 1×10^{-5} (MTCA Method C criterion), considering combined seafood ingestion, sediment contact and incidental sediment ingestion pathways;
- A cumulative hazard index under future RME conditions of 1, also based on a cumulative pathway analysis;
- No identified risk to aquatic biota and other wildlife; and
- Compliance with applicable or relevant and appropriate requirements (ARARs), including State of Washington surface water quality standards (Chapter 173-201A WAC) and sediment management standards (Chapter 173-204 WAC).

The cleanup levels and cleanup goals relevant to the Landfill and Clam Bay areas of the Site are summarized in Table 15.

8.3 Fire Training Area

Besides the Landfill/Clam Bay area, the only other area of the Site which poses an identified risk to human health and the environment is the Fire Training Area (Figure 8). The risk assessment identified potential threats associated with dioxin/furan congeners detected primarily within the simulator areas. Based on the risk assessment, the following remedial action objectives were developed for the Fire Training area:

- Prevent human and wildlife contact with simulator debris and soils containing dioxin/furan concentrations greater than the cleanup level; and
- Minimize solubilization and migration of TPH into groundwater.

As discussed above, the Site is not an existing or potential future residential site, nor does the Site qualify as an industrial site under the MTCA cleanup regulation. Chemical-specific cleanup levels and cleanup goals were developed for this upland area of the Site using the baseline risk assessment along with the following risk management goals:

- A cumulative cancer risk goal under future RME conditions of 1×10^{-5} (MTCA Method C criterion), considering cumulative soil contact incidental soil ingestion, inhalation, and drinking water pathways;
- A cumulative hazard index under future RME conditions of 1, also based on a cumulative pathway analysis; and
- Compliance with ARARs including State of Washington MTCA Method C soil cleanup levels for non-industrial sites (WAC 173-340-740).

The cleanup levels and cleanup goals relevant to the Fire Training Area are summarized in Table 15. A soil cleanup goal for TPH (as diesel) was established for this area of the Site based on the MTCA Method A (routine) cleanup level. However, since the site-specific risk assessment and leachability testing indicated only a low risk from TPH, no chemical-specific cleanup level is necessary.

8.4 Net Depot and Manchester State Park

Baseline risks within the former Net Depot (current EPA laboratory) and Manchester State Park areas of the Site were determined to be below both human health and environmental risk management goals (i.e., cancer risks below 1×10^{-5} , Hazard Index below 1, and no identified risk to the upland environment). Consolidation of relatively small quantities of solid waste from the Manchester State Park to the current EPA property is anticipated as a result of the presumptive remedy (landfill capping), primarily because the presence of a utility corridor which runs along the property boundary may interfere with remediation if the wastes are not relocated. (Construction of the cap over the utility corridor should be avoided. As an alternative to waste consolidation, the utility corridor may be relocated.) Accordingly, no further remedial action objectives were developed for the Net Depot and Manchester State Park areas of the Site.

8.5 Groundwater

Currently, water supply for the NMFS and EPA facilities is provided by an off-site source. With the exception of the Outwash Aquifer, near the Fire Training Area at the southern edge of the Site, groundwater present throughout the Site is not a current or potential source of water supply. No chemicals have been detected at concentrations above risk-based and aesthetic screening levels in shallow groundwater below the Fire Training Area or within the Outwash Aquifer. The Fire Training Area is the only area at the Site which occurs near the water supply aquifer (Outwash Aquifer). The low potential risk to human health associated with groundwater at the Site was also confirmed by the site-specific risk assessment (cancer risk less than 10^{-6} ; hazard index less than 0.3). Accordingly, no remedial action objectives were developed for Site groundwater, outside of the seep cleanup levels applicable to the landfill shoreline area (see Table 15).

8.6 Remediation Areas and Volumes

Areas exceeding soil and sediment cleanup levels in the Landfill/Clam Bay portion of the Site are shown on Figure 7. Areas exceeding soil cleanup levels and cleanup goals in the Fire Training Area are shown on Figure 8. (The Net Depot and Manchester State Park areas of the Site comply with all cleanup levels.) Site-wide area and volume estimates for all media exceeding soil and sediment cleanup levels are provided in Table 16. The entries in this table reflect further refinement of the areas and volumes presented in Table 3-3 of the Feasibility Study.

9.0 DESCRIPTION OF ALTERNATIVES

Various cleanup alternatives ranging from no action to complete removal/treatment of contaminated materials were identified and evaluated in the Feasibility Study (FS). Area-specific subsets of these alternatives were considered in the Proposed Plan, as discussed below.

9.1 Alternatives for the Landfill and Clam Bay Sediments

Of the six alternatives evaluated in the FS for cleanup of the Landfill and Clam Bay sediments, the following four were considered in the Proposed Plan:

- (1A) No Action (FS Alternative A1).

- (2A) Capping of Upland Landfill, Armoring over Intertidal Debris, and Placement of a Thin Cap over Remaining Impacted Sediments (FS Alternative A2).
- (3A) Capping of Upland Landfill, Excavation of Intertidal Debris and Placement of Design Fill, and Placement of a Thin Cap over Remaining Impacted Sediments (FS Alternative A5).
- (4A) Excavation/Dredging, Limited Treatment and Off-Site Disposal of All Landfill Debris, Soils, and Impacted Sediments (FS Alternative A6).

Descriptions of these four alternatives are presented below.

Alternative 1A-No Action. The No Action Alternative provides a baseline against which to compare the other alternatives to evaluate their effectiveness. Under this alternative, the Landfill and Clam Bay sediments would be left as they currently exist.

Alternative 2A-Capping of Upland Landfill, Armoring over Intertidal Debris, and Placement of a Thin Cap over Remaining Impacted Sediments. This alternative includes capping the upland portion of the Landfill, placing a hydraulic cutoff system upslope of the cap, placing a rock and cobble armor over the portion of the Landfill that extends into Clam Bay, and placing a thin cap over impacted sediments in Clam Bay.

Prior to cap construction, any solid waste located west of the utility corridor which runs along the EPA/Manchester State Park property boundary would be excavated and placed on the remaining upland landfill area. (Alternatively, the utility corridor could be relocated to outside the solid waste area.) The cap would be designed to meet state Minimum Functional Standards requirements and be consistent with the long-term plans for the property. The hydraulic cutoff system would keep groundwater and surface water from entering the Landfill along its upslope edge. Figure 9 shows the approximate areal extent of the landfill cap and hydraulic cutoff system.

Armoring of the landfill areas lying within the intertidal zone of Clam Bay would prevent further erosion of the landfill waste and provide a physical barrier to keep people and wildlife away from the debris. Figure 10 shows a schematic cross section of the armor layer. It may be 2 to 3 feet thick and would be filled with finer grained soils to provide a suitable environment for marine organisms. The armor layer would raise the elevation of the beach, causing an outward (seaward) shift in the high water line, and resulting in the loss of up to one acre of existing aquatic area. Based on input from the Manchester Site RI/FS Work Group, measures to mitigate the loss of aquatic habitat would need to be considered as part of this alternative.

Prior to placement of the armor layer, a cap consisting of clean sediments or similar material would be placed over the silt basin sediments to isolate them from the intertidal environment. Sufficient cap material would be placed to fill the existing depression flush with the surrounding mudline (nominal 2-foot cap thickness).

Rows of clean sediment (windrows) would be placed over sediments exceeding sediment cleanup levels in the intertidal zone of Clam Bay which are not covered by the armor layer or silt basin cap. Tide and wind forces would spread the clean sediment out naturally and evenly over time. Remaining sediments with low concentrations of PCBs (exceeding the cleanup goal but posing minimal risk) are expected to recover rapidly once the source of contamination, erosion of the landfill waste, is eliminated. The natural recovery of these sediments, without the thin layer capping of sediments exceeding the sediment cleanup levels, was predicted to occur largely by burial and resuspension processes, based on modeling performed during the RI/FS. The addition of clean sediment in those areas exceeding the sediment cleanup levels should enhance the recovery of these remaining sediments through burial processes.

Long-term land use restrictions to prevent activities which could damage the cap, and a cap maintenance program, would be implemented. Potential construction impacts to the freshwater wetlands adjacent to the southern edge of the landfill (and to the potential emerging wetlands on the landfill area itself) would be addressed during final design. Restrictions on subsistence-level shellfish harvesting would apply until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting. Unacceptable human health risks of consuming shellfish were found only at subsistence consumption rates (which are considerably higher than recreational consumption rates) of shellfish from tidelands adjacent to the Landfill and Fire Training Area. Sediment and tissue cleanup goals are predicted to be met 3 to 5 years after remedial construction is completed. Sediment and shellfish tissue in Clam Bay would be monitored periodically by the Corps to track recovery.

Any seeps observed during low tides would also be monitored for water quality. Based on a preliminary analysis, placement of the armor layer, installation of the hydraulic cutoff system, and capping of the upland landfill would likely reduce the metals concentrations in seep discharge to below cleanup levels. Seep discharge would be further evaluated as part of the final design.

Alternative 3A-Capping of Upland Landfill, Excavation of Intertidal Debris and Placement of Design Fill, and Placement of a Thin Cap over Remaining impacted Sediments. This alternative is similar to Alternative 2A described above in terms of capping of the upland Landfill, except that landfill debris in the intertidal zone would be excavated and placed on the upland Landfill prior to capping. The objective of this alternative is to minimize the impact to the aquatic habitat and maximize long-term beach stability. The excavation backfill would include a "design fill" component to help achieve water quality criteria in the seeps by reducing the flux of contaminants leaching from landfill materials (without altogether eliminating tidal exchange), and enhancing tidal dispersion and seawater mixing. The backfill must also provide erosion protection and the best possible habitat for marine organisms. The areal extent of the backfill would be limited to the pre-excavation footprint of the landfill wastes.

Figure 11 shows the conceptual design of the excavation backfill used in the FS for cost estimating purposes. It was assumed that the silty sand layer beneath the intertidal debris would be excavated along with the debris itself, so that the design fill material could be keyed into the underlying sandy silt. However, design of the excavation and backfill requirements under this alternative, including the need to excavate the silty sand layer, would be determined during the remedial design phase.

Excavation of the intertidal landfill debris (volume estimated at 7,000 to 10,000 cubic yards) is expected to be difficult because of the presence of submarine nets and the agglomerated nature of the debris. Special equipment may be required, including hydraulic shears and torches, to facilitate debris excavation and size reduction to allow placement/compaction in the upland landfill. Protective measures such as a temporary dike would be constructed offshore to prevent inundation at high tide and minimize the potential for drainage of landfill runoff and suspended sediment into Clam Bay during excavation/construction activities. The same land use restrictions, cap maintenance, restrictions on shellfish harvesting, and sediment/tissue monitoring as in Alternative 2A would apply. Sediment and tissue cleanup goals are predicted to be met 3 to 5 years after remedial construction is completed.

Alternative 4A-Excavation/Dredging, Limited Treatment, and Off-Site Containment of All Landfill Debris, Soils, and Impacted Sediments. In this alternative, all landfill debris (both intertidal and upland) would be excavated and disposed of in an approved off-site landfill. During the RI/FS investigation, roughly half of the landfill soil samples analyzed by TCLP failed for lead, indicating that a large fraction of landfill materials may be characterized as hazardous waste and, therefore, require special handling and treatment before disposal.

A very large volume of soil/debris would need to be excavated in this alternative. As with the intertidal debris, upland debris is expected to be difficult to excavate. The uplands excavation area would be restored by backfilling with clean imported fill and revegetating. The intertidal excavation would be backfilled with cobble and habitat material.

All Clam Bay sediments exceeding the cleanup levels would also be removed and disposed of in an off-site landfill. No long-term monitoring would be necessary for Alternative 4A.

It is estimated that Alternative 4A would require more than 2 years of field implementation. By contrast, construction in Alternatives 2A and 3A could likely be completed in a single construction season.

9.2 Alternatives for the Fire Training Area

Of the five alternatives evaluated in the FS for cleanup of the Fire Training Area, the following three were considered in the Proposed Plan:

(1B) No Action (FS Alternative B1);

(2B) Removal of All Dioxin-Contaminated Materials and In-Place Closure of USTs (FS Alternative B3).

(3B) Removal of USTs and All Petroleum- and Dioxin-Contaminated Materials (FS Alternative B5).

Descriptions of these three alternatives are presented below.

Alternative 1B-No Action. The No Action Alternative provides a baseline against which to compare the other alternatives to evaluate their effectiveness. Under this alternative, the USTs and all petroleum- and dioxin-contaminated materials would be left in-place.

Alternative 2B-Removal of All Dioxin-Contaminated Materials and In-Place Closure of USTs. In this alternative, debris contained in structures within the main simulator complex with high concentrations of dioxin would be transported for disposal in an approved RCRA hazardous waste landfill. Limited areas of lower concentration dioxin-impacted soil outside the main simulators and soil/debris located north of the

simulators would be excavated and disposed of in an approved off-site landfill. Soils beneath the simulators would be sampled and analyzed only if evidence of potential leakage through the simulator structures is identified. The structures would be demolished if needed to complete removal of dioxin-impacted soils.

USTs in the Fire Training Area would be closed in-place following state UST closure requirements. Piping systems and a small volume of TPH-impacted soils excavated incidentally along with the piping, would be disposed of off site. To address remaining soils with TPH concentrations greater than the Site cleanup goal (200 ppm), there would also be restrictions and guidelines established for activities which may disturb areas where these soils are left in-place.

Alternative 3B-Removal of USTs and All TPH- and Dioxin-Contaminated Materials. Similar to Alternative 2B, this alternative includes excavation and off-site disposal of all dioxin-contaminated soil and debris.

Instead of being closed in-place, USTs would be removed and disposed of off site using conventional methods. In addition, soils with TPH concentrations greater than the Site cleanup goal would be excavated and biologically treated (via landfarming) on Site to achieve the cleanup goal. Structures in the immediate vicinity of the TPH-impacted soils (including the fire training stations and the main simulator complex) would be demolished and removed from the Site.

Implementation of Alternatives 2B and 3B could be completed in a single construction season.

9.3 Alternatives for the Net Depot and Manchester State Park

"No Action" is the only alternative considered in the Proposed Plan for the Net Depot and Manchester State Park areas of the Site, since these areas were not identified as posing a risk to human health or the environment. [As discussed in Section 8.4, the small portion of the landfill located on Manchester State Park property will be addressed under the presumptive remedy (landfill capping)]. This alternative would result in the Net Depot and Manchester State Park areas of the Site being left in their current condition.

10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the remediation alternatives discussed above were evaluated against the nine criteria specified by the NCP. The nine criteria include:

- Two threshold criteria (overall protection of human health and the environment, and compliance with ARARs), which must be met for an alternative to be selected;
- Five balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost) for comparing and choosing a preferred alternative, and
- Two modifying criteria (state acceptance and community acceptance) which are factored into selection of the final cleanup action.

The following sections discuss and compare remediation alternatives relative to the above criteria.

10.1 Evaluation of Landfill and Clam Bay Alternatives by Criteria

Overall Protection of Human Health and the Environment. Alternatives 2A, 3A, and 4A are protective of human health and the environment in terms of reducing the risk of impacts from landfill contamination. Site risk reduction is achieved in Alternatives 2A and 3A primarily by isolating impacted media from human contact and the environment; however, Alternative 2A would result in the loss of up to 0.9 acre of aquatic habitat. In Alternative 4A, it is achieved by removing impacted media from the Site.

No Action (Alternative 1A) is not protective of human health or the environment, the thus will not be considered further in this evaluation.

Compliance with ARARs. Alternatives 3A and 4A, which include removal of the intertidal debris and excavation and removal of the entire landfill, respectively, comply with all ARARs. There was considerable discussion within the Manchester Work Group on whether Alternatives 2A will achieve compliance with all ARARs. One areas of uncertainty with Alternative 2A, raised by the state, is the compliance of seep discharges at the landfill toe with surface water quality criteria. Although preliminary evaluations of the expected performance of Alternative 2A indicated that landfill capping and other hydraulic controls included in this alternative would be more likely than not to achieve compliance with surface water quality criteria at the seepage discharge point(s), this condition could not be fully evaluated without detailed modeling, which was beyond the scope of the FS.

In addition, the natural resource agencies in the Work Group articulated their position that habitat mitigation would be necessary under Alternative 2A to compensate for the loss of aquatic habitat function and area. Although preliminary on-site mitigation options were identified which would partially restore historical salt marsh habitat within this area and create more aquatic area than would be lost, the resource agencies determined that other remedial options such as Alternative 3A provided a practicable alternative to Alternative 2A which could obviate the need for any compensatory mitigation. Because the Washington State Hydraulic Code Rules (Chapter 220-110 WAC) set forth priorities to avoid or minimize aquatic habitat impacts wherever possible, and allow consideration of compensatory mitigation only when impacts are unavoidable, the resource agencies concluded that selection of Alternative 2A may not be consistent with the state ARAR.

The Manchester Work Group was not able to reach an agreement on what constituted the need for or an appropriate level of mitigation (e.g., ratio of replacement habitat to lost or impacted habitat), in part because there is currently no clear state or federal regulatory criteria for determining the need for and level of mitigation for actions taken at CERCLA sites. Consequently, Alternative 2A has a greater level of uncertainty with respect to ARAR compliance, possibly with attendant cost and schedule impacts.

Long-Term Effectiveness and Permanence. The landfill cap and upgradient hydraulic cutoff system included in Alternatives 2A and 3A prevent direct contact exposure to upland landfill debris and effectively isolate the debris from precipitation and groundwater infiltration. Provided these systems receive periodic maintenance, they are expected to achieve long-term protection.

The landfill toe remedial components of Alternatives 2A and 3A both prevent direct contact exposure to landfill debris in the intertidal zone. However, Alternative 3A does provide some consolidation of the landfill waste by excavating the landfill toe and placement in the upland portion of the landfill. Alternative 3A is also designed to provide sufficient isolation of the debris from intertidal flushing such that cleanup levels are achieved at the seeps. Both Alternatives 2A and 3A appeared to be generally similar in terms of their permanence, relative to susceptibility to beach erosion, though additional design analyses would be necessary to fully evaluate this condition. Excavation and placement of design fill under Alternative 3A would afford greater waste isolation in a severe beach erosion event based on the greater thickness of clean fill materials.

Alternative 4A provides long-term effectiveness and permanence at the Site by removing all materials exceeding cleanup levels. A large portion of these materials would be contained off site.

Reduction of Toxicity, Mobility, or Volume through Treatment. Alternatives 2A and 3A do not include any treatment to reduce toxicity, mobility, or volume of site contaminants. In Alternative 4A, all characteristic Dangerous Waste materials from the landfill undergo on-site stabilization to reduce the potential for metals leaching. The portion of the landfill debris which is likely to characterize as Dangerous Waste is unknown.

Short-Term Effectiveness. Short-term effects associated with the construction/implementation phase of a remedial alternative include impacts to the environment to construction workers, and to the adjacent community (including employees working at the EPA/Ecology Environmental Laboratory and the NMFS Field Station). Capping of the upland landfill (Alternatives 2A and 3A) is expected to have minimal short-term impacts. The existing landfill cover soil provides protection against exposure to upland landfill debris. Dust control measures during construction would be important to minimize short-term inhalation risks and to minimize airborne particulate releases and associated quality control problems within the environmental laboratories. The general public does not have access to the Landfill Area. An alternative access route to the EPA laboratory may need to be provided during construction activities.

The major potential impact associated with construction in the intertidal zone is short-term degradation of the aquatic environment. The impacts of construction activities in Alternative 2A, which include placement of protective armor over the landfill toe, are expected to be relatively minor. Intertidal construction activities in Alternative 3A are more extensive, including debris excavation at the landfill toe. Short-term impacts associated with excavation of landfill debris in the intertidal zone include disturbance of aquatic habitat during placement and removal of a tidal dike and debris removal, and potential release of contaminants associated with landfill debris to the environment. Measures taken to minimize short-term impacts to the aquatic environment would include working during low tides to the extent possible, and placement of a temporary dike during debris excavation to prevent erosion of cut faces into Clam Bay.

Excavation of landfill debris in Alternatives 3A and 4A would subject construction workers to significantly higher constituent concentrations compared to Alternative 2A due to the increase level of waste excavation and disposal. Exposure potential would be largest by far in Alternative 4A, where all landfill debris would be excavated.

Implementability. The construction components of Alternative 2A require only conventional methods and

equipment, and are readily implemented. However, the implementability of mitigation measures required with Alternative 2A are uncertain, since the type and extent of mitigation have not been determined.

Alternative 3A requires partial excavation of the landfill (the intertidal portion only), and Alternative 4A requires complete excavation of all landfill debris. Landfill debris is expected to be difficult to excavate because of submarine nets and agglomerated wastes reported to be present. Size reduction of the excavated debris may also be difficult using conventional methods. Field trials of excavation and/or size reduction techniques may be required prior to remedial design of an action which includes excavation of landfill debris.

The on-site treatment (stabilization), transportation, and disposal components of Alternative 4A would all likely present major implementation hurdles based on the large quantity of material involved. An estimated 140,000 tons of material would be transported off the Site. Even assuming that only a small fraction of excavated materials would require stabilization, the construction phase of Alternative 4A would likely require several years to implement

Alternatives 2A through 4A involve dredge and fill activities in the Clam Bay intertidal zone. These activities would require coordination with several government agencies, leading to possible implementation difficulties and delays.

Construction in Alternatives 2A through 4A would impact the only access road to the EPA/Ecology Environmental Laboratory. Provision must be made for access to these facilities. The institutional controls required in Alternatives 2A and 3A are considered easy to implement.

Cost. The estimated cost of each remediation alternative for the Landfill and Clam Bay is shown below:

Alternative	Initial Costs	Present Worth of Annual O&M Costs	Present Worth of Total Costs
1A	\$0	\$0	\$0
2A	\$3,100,000	\$370,000	\$3,500,000
3A	\$4,600,000	\$260,000	\$4,900,000
4A	\$47,000,000	\$0	\$47,000,000

Notes:

(1) Present worth estimates assume an annual inflation rate of 2.2 percent. A maximum project life of 30 years is assumed, in accordance with EPA guidance. Estimates are in 1996 dollars.

State Acceptance. The State of Washington has reviewed the Landfill and Clam Bay alternatives, and has expressed a strong preference for Alternative 3A which involves excavation of the landfill toe from the intertidal zone. The state has also indicated that armoring of the landfill toe under Alternative 2A would require mitigation measures to offset the loss of aquatic habitat.

Public Acceptance. The public has had the opportunity to review and comment on the range of alternatives considered for remediation of the Landfill and Clam Bay. At the employee briefing on the preferred alternative, several concerns were raised regarding implementation of the remedial action, including issues of site access, employee health and safety, and disruption of laboratory functions. As noted in the Responsiveness Summary (Attachment A), the on-site laboratories will have opportunities to review and comment on draft versions of the remedial design and construction documents, to assure that employee concerns are addressed before construction activities begin.

The overall supportive public comments received during the comment period for the Proposed Plan and at the public meeting have been interpreted as acceptance of the proposed alternative.

10.2 Evaluation of Fire Training Area Alternatives by Criteria

Overall Protection of Human Health and the Environment Alternatives 2B and 3B are protective of human health and the environment in terms of reducing the risks associated with dioxin-impacted soil and debris in the Fire Training Area. The primary difference between the alternatives is the extent to which TPH-impacted soils are cleaned up. These soils are excavated and treated on the Site in Alternative 3B. However, since the TPH-impacted soils represent a limited Site risk, this alternative is only slightly more protective than

Alternative 2B.

No Action (Alternative 1B) is not protective of human health or the environment, thus will not be considered further in this evaluation.

Compliance with ARARs. Alternatives 2B and 3B comply with all ARARs.

Long-Term Effectiveness and Permanence. Off-site disposal of dioxin-impacted soil and debris in Alternatives 2B and 3B permanently removes from the Site all risks associated with those materials. However, containment is not normally regarded as a permanent technology. Both Alternative 2B and 3B are similar in terms of the reduction of Site risk. By leaving the TRH-impacted soils in-place, Alternative 2B provides some potential for future exposure, although the petroleum residual is largely non-leachable and poses only a minimal risk at the Site. Landfarming (Alternative 3B) provides permanent reduction of TPH in soil to below the cleanup goal.

Reduction of Toxicity, Mobility, or Volume through Treatment. As noted above, landfarming of TPH-impacted soils in Alternative 3B reduces the toxicity of these soils, whereas Alternative 2B leaves TPH-impacted soils untreated. PCB-impacted petroleum product/sludge removed from the USTs would be disposed of off the Site by placement in an approved landfill or incineration.

Short-Term Effectiveness. The greatest exposure risk to construction workers is in the removal of the debris from inside the simulators, which is a component of Alternatives 2B and 3B. Excavation of dioxin-contaminated surficial soil and external debris presents less of an exposure risk, based on the lower concentrations found in those materials. Exposure risks associated with UST closure/removal and TPH-impacted soil excavation/bioremediation are relatively minor. Construction worker exposure would be minimized through the use of protective clothing, dust control, and respirators if required.

Alternatives 2B and 3B are not expected to have appreciable short-term impacts on the environment or on the local community.

Implementability. The construction components of Alternatives 2B and 3B require only conventional methods and equipment, and are readily implemented. Biological treatment of TPH-impacted soil via landfarming (Alternative 3B) has been demonstrated at many sites, and is readily implemented. The institutional controls associated with the TPH-impacted soils left in-place in Alternative 2B are considered easy to implement.

Cost. The estimated cost of each remediation alternative for the Fire Training Area is shown below:

Alternative	Initial Costs	Present Worth of Annual O&M Costs	Present Worth of Total Costs
1B	\$0	\$0	\$0
2B	\$740,000	\$0	\$740,000
3B	\$2,400,000	\$0	\$2,400,000

Notes:
(1)Present worth estimates assume an annual inflation rate of 2.2 percent. A maximum project life of 30 years is assumed, in accordance with EPA guidance. Estimates are in 1996 dollars.

State Acceptance. The State of Washington has reviewed the Fire Training Area alternatives and has expressed a preference for Alternative 2B as an appropriate response action. The state has approved this document and the selected remedy.

Public Acceptance. The public has had the opportunity to review and comment on the range of alternatives considered for remediation of the Fire Training Area. The overall supportive public comments received during the comment period for the Proposed Plan and at the public meeting have been interpreted as acceptance of the proposed alternative.

11.0 THE SELECTED REMEDY

The alternative selected for the remedial action at the Manchester Annex Superfund Site is generally consistent with Alternative 3A for the Landfill and Clam Bay sediments, Alternative 2B for the Fire Training Area, and No Action for the Net Depot Area and Manchester State Park. This remedy is preferred because it complies with all ARARs, provides long-term protection of human health and the environment, and is consistent

with the state preference, while striking a balance between Site risk reduction and cost. The remedial action, to the extent practicable, will be carried out in a manner that is not likely to jeopardize listed species or adversely affect critical habitat.

The selected remedy, which will cost an estimated \$5.4 million (present worth), includes the following actions.

11.1 Excavation of Intertidal Debris and Placement of Design Fill

- Landfill debris located in the intertidal zone of Clam Bay will be excavated to the extent necessary to establish a stable shoreline protection system and to allow placement of the design fill (described below). The goal is no net loss of aquatic habitat. A temporary dike or other means will be used to prevent erosion of cut faces into Clam Bay, and construction methods will be selected during remedial design/remedial action to minimize disturbance of the intertidal area adjacent to the excavation. The volume of intertidal debris requiring excavation is estimated to be in the range of 7,000 to 10,000 cubic yards.
- As described in Larson (1997), it is possible that low-density hunter-fisher-gatherer deposits are on the former beach surface underlying the intertidal debris. A Cultural Resources Management Plan will be prepared during remedial design which specifies monitoring procedures, personnel qualifications, notification requirements, and treatment of cultural resources if they are discovered during remedial construction.
- Excavated material will be placed, to the extent possible, on the upland landfill area prior to capping. Based on the presence of submarine nets and the agglomerated nature of the debris, some of the excavated material may be too large or otherwise physically unsuitable for placement/compaction on Site. If determined during remedial design to be cost-effective, techniques such as shearing will be used to reduce the size of excavated debris so that it can be effectively placed on the on-site landfill. Debris that is physically unsuitable for placement on the landfill and not amenable to size reduction will be tested for waste designation purposes and disposed of in an appropriate off-site landfill.
- The shoreline protection system will be designed to achieve seep cleanup levels (Table 15), provide the best possible habitat for marine organisms, and maximize long-term beach stability. It will include a "design fill" component to help achieve water quality criteria in the seeps by reducing the flux of contaminants leaching from landfill materials (without altogether eliminating tidal exchange), and enhancing tidal dispersion and seawater mixing. Details of the shoreline protection system will be refined during final design.
- Seeps at the foot of the finished construction, if observed, will be monitored until compliance with seep discharge cleanup levels is established. Additional remedial measures will be implemented, as necessary, if seep discharge cleanup levels are not achieved.

11.2 Placement of Thick Sand Cap over Silt Basin Sediments

- A cap, consisting of clean sediments or similar material, will be placed in the existing intertidal depression ("silt basin") flush with the surrounding mudline, to isolate contaminated basin sediments from the intertidal environment. Placement of the cap will be coordinated with windrow placement (discussed below).

11.3 Placement of Thin Cap over Remaining Surficial Sediments Exceeding Cleanup Levels

- A thin cap of clean sediment will be established over intertidal Clam Bay sediment areas which exceed cleanup levels, which are the SQS. The cap area is estimated at roughly 5 acres. Cap material will be placed in windrows, designed to be spread out evenly over time by wind and wave forces. To the extent practicable, the gradation of the material used will be matched with the existing native sediment grain size.
- Details of thin capping (including volume of clean sediment applied, windrow design, etc.) will be determined during final design. The overall goal is to reduce contaminant concentrations in surficial sediments sufficiently to assure that sediment dwelling organisms, including harvestable shellfish resources, are adequately protected to support unrestricted use of the cap area within several years of completion of the remedial action.
- Clam Bay sediment and shellfish tissue will be monitored in intertidal areas currently

exceeding the PCB cleanup goal for sediments (40 ug/kg [dry]) until compliance with sediment and shellfish tissue cleanup goals is established, or until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting; whichever occurs first.

11.4 Installation of Landfill Cap and Hydraulic Cutoff System

- Prior to cap construction, any solid waste located west of the utility corridor which runs along the EPA/Manchester State Park property boundary will be excavated and placed on the remaining upland landfill area. (Alternatively, the utility corridor will be relocated to outside the areal extent of solid waste.)
- After placement of debris excavated from the intertidal area and Manchester State Park (or relocation of the utility corridor), the upland portion of the landfill (approximately 5 to 6 acres) will be capped in accordance with the State of Washington's Minimum Functional Standards (MFS) for solid waste landfill closures. (Design requirements of an MFS cap include a low-permeability cover liner with a 2 percent minimum slope, protective layers above and below the cover liner, landfill gas controls, and close construction quality control and inspection requirements.) The cap will be designed to be consistent with the owner's long-term plans for the property, which may include use of a portion of the landfill area as parking for a future laboratory expansion.
- A hydraulic cutoff system will be installed upgradient of the landfill area, to capture groundwater and surface water approaching the upgradient edge of the landfill cap, divert captured water around the landfill, and discharge it to Clam Bay. The system will be designed such that it will not serve as a conduit for seawater infiltration into the landfill during high tides.
- Potential construction-related impacts to existing wetlands in the landfill vicinity will be identified and addressed as part of final design.
- After completion of upland construction, the area will be revegetated, consistent with long-term O&M requirements and site development plans.
- A post-closure plan for the landfill cap, hydraulic cutoff system, and shoreline protection system, will be developed during remedial construction and implemented following construction. The post-closure plan will address long-term operation, monitoring, inspection, and maintenance requirements for these systems.

11.5 Excavation/Disposal of Dioxin-Contaminated Debris and Soil

- Dioxin-contaminated debris (volume estimated at 200 cubic yards) will be removed from the main simulator complex in the Fire Training Area and disposed of in a RCRA hazardous waste landfill.
- After removal of debris, the floors of the simulators will be inspected for cracks or other routes of potential leakage. If routes of potential leakage are found, soils beneath the simulators will be sampled and analyzed for dioxins. If dioxin concentrations above the cleanup level are detected, the simulator(s) will be demolished, and the underlying contaminated soils excavated.
- Near-surface soils adjacent to the main simulator complex, and the soil/debris pile north of the main complex, will be sampled and analyzed for dioxins. Soil and debris with concentrations above the cleanup level (estimated at 200 to 300 cubic yards) will be excavated for off-site disposal.
- Excavated dioxin-contaminated debris and soil, and simulator demolition debris (if applicable), will be tested for waste designation purposes and disposed of in appropriate off-site landfills.

11.6 In-Place Closure of USTs

- The concrete USTs (five or more) remaining in the Fire Training Area will be closed in-place following state UST closure requirements. Pumpable materials will be removed from the USTs and associated piping, tested for waste designation purposes, and treated/disposed of off Site in an appropriate manner.
- UST piping systems, and TPH-impacted soil excavated incidentally along with the piping, will be

disposed of in an appropriate off-Site landfill. The goal will be to remove all UST system piping. However, pipe sections which are impractical to remove (due to existing utilities or other obstacles), will be purged and abandoned in-place.

11.7 Institutional Controls

In conjunction with the landowners, the Corps will develop and put into place the following institutional controls:

- A description of the activities or prohibitions required for continued maintenance and protection of the remedial action, including the landfill cap, shoreline protection system, and hydraulic cutoff system, will be prepared during remedial design. These requirements will be subsequently placed in the GSA files, the County Land Use Records, and all applicable public files for the property, including locations at the site, EPA regional office, and EPA headquarters. In addition, deed covenants prohibiting future residential use of the property, and describing the maintenance and protection requirements, will be prepared and submitted for EPA approval. The deed covenants shall be executed upon any future transfer of the property out of federal government ownership.
- A restriction on subsistence-level harvesting of shellfish until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting. The Suquamish Tribe will be responsible for prohibiting subsistence-level harvesting of shellfish.
- An institutional control plan, including deed covenants as necessary, will be prepared and submitted for NMFS approval to address TPH-impacted soil left in-place in the Fire Training Area. The institutional control plan shall include the following (as appropriate):
 - ▶ Execution of a deed covenant prohibiting future residential use of the property, and describing the presence of TPH-impacted soils, including information on location/depth, concentrations, and health and safety concerns;
 - ▶ All contractors and employees working in future subsurface excavations within and adjacent to the UST areas of the Site will be notified of the requirement to utilize health and safety precautions normally applicable to UST removals;
 - ▶ Temporary storm water controls and other best management practices (BMPs) such as temporary soil covers and subsurface liners will be used during future soil excavation activities in these areas to minimize infiltration and runoff of soil materials;
 - ▶ Subsurface soil excavations within these areas will be observed by a qualified environmental professional to determine if such soils contain free product. If free product is encountered, off-Site landfill disposal of these materials will be the prospective remedy. If free product is not encountered, the soils will be allowed to be returned to the original excavation, or very close to the original excavation in a substantially similar environment; and
 - ▶ Future storm water runoff systems at the Site will be designed to divert runoff away from the former UST areas.

NMFS will be responsible for ensuring long-term compliance with the institutional control plan for the NOAA property. Compliance with this plan will obviate the need for further sampling or remedial actions associated with TPH-impacted soil left in-place in the Fire Training Area.

Each property owner will ensure that future construction will not compromise the institutional controls that are put into place. The effectiveness of the institutional controls will be evaluated as part of reviews to be conducted at 5-year intervals, at a minimum, or as required based on the performance evaluation criteria of this remedy.

The Manchester Annex Work Group will continue to function during planning and implementation of the selected remedy. Interested parties, such as Site employees, will be encouraged to be involved in design and construction issues through the Work Group.

12.0 STATUTORY DETERMINATIONS

The remedial action for implementation at the Manchester Annex Superfund Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains all ARARs, and is cost-effective.

12.1 Protection of Human Health and the Environment

The selected remedial action is protective of human health and the environment through a combination of on-Site containment/capping, beach stabilization, off-Site disposal, and institutional controls. Excavating the intertidal landfill debris, constructing a stable beach, capping the upland landfill, and installing a hydraulic cutoff system upgradient of the landfill will isolate landfill wastes from human contact and the environment, and reduce or eliminate future contaminant discharges to Clam Bay. Capping of the "silt basin" and placement of a thin cap over remaining impacted sediments, enhancing the natural recovery process, will reduce surface sediment and shellfish tissue chemical concentrations to levels protective of human health and the environment. Temporary restrictions on subsistence-level harvesting of shellfish will ensure protection of public health until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting.

Excavation and off-site disposal of dioxin-impacted debris and soil will address the primary risk concerns in the Fire Training Area. Institutional controls addressing TPH-impacted soil left in-place at the Site will provide protection of human health and the environment from these materials.

12.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy will comply with all chemical-, action-, and location-specific applicable or relevant and appropriate requirements (ARARs). The ARARs are presented below.

Landfill Area, Clam Bay, and Fire Training Area ARARs

- The State of Washington Hazardous Waste Management Act (Chapter 70.105 RCW) establishes requirements for dangerous waste and extremely hazardous waste, as codified in Chapter 173-303 WAC. This regulation is applicable to wastes that are taken outside an existing area of contamination. The regulation designates those solid wastes which are dangerous or extremely hazardous to the public health and the environment; provides surveillance and monitoring requirements for such wastes until they are detoxified, reclaimed, neutralized, or disposed of safely; and establishes monitoring requirements for dangerous and extremely hazardous waste transfer, treatment, storage, and disposal facilities.
- The State of Washington Hazardous Waste Cleanup - Model Toxics Control Act (MTCA; Chapter 70.105D RCW) establishes requirements for the identification, investigation, and cleanup of facilities where hazardous substances have come to be located, as codified in Chapter 173-340 WAC. Soil, groundwater, and surface water cleanup standards established under the MTCA, along with overall cancer risk and hazard index requirements, are applicable for determining remediation areas and volumes and compliance monitoring requirements within the Landfill Area, Clam Bay, and Fire Training Area of the Site.
- The State of Washington Sediment Management Standards (SMS; Chapter 173-204 WAC) establish chemical-specific sediment quality standards (SQS) which are applicable within Clam Bay to control potential adverse effects on biological resources. Sediments must meet the cleanup standards within ten years after completion of the remedial action.
- The State of Washington Surface Water Quality Standards (SWQS; Chapter 173-201A WAC), as developed pursuant to the federal ambient water quality criteria (40 CFR 131) are applicable chemical-specific standards for determining cleanup requirements for surface water discharges, including tidal seeps from the landfill area.
- The Toxic Substances Control Act (TSCA) establishes storage and disposal requirements for wastes containing PCBs greater than 50 ppm (40 CFR 761). These requirements are applicable to wastes that are taken outside of an existing area of contamination.
- The State of Washington Clean Air Act (Chapter 70.94 RCW), including Implementation of Regulations for Air Contaminant Sources (Chapter 173-403 WAC), and Controls for New Sources of Toxic Air Pollutants (Chapter 173-460 WAC) are applicable standards for determining ambient concentrations of toxic air contaminants allowed during remedial actions conducted throughout the Site. In addition, requirements for control of fugitive dusts and other air emissions during excavation and cleanup-related activities, as codified in WAC 173-400-040, are also applicable to remedial actions.

- Sections 401 and 404(b)(1) of the Federal Clean Water Act (40 CFR 230) and Section 10 of the Rivers and Harbors Act (33 CFR 320-330) protect marine environments and prevent unacceptable adverse effects on shellfish beds, fisheries, wildlife, and recreational areas during dredging activities. These regulations are applicable to excavation, dredging, and fill activities conducted in the intertidal area of Clam Bay and in possible wetlands within the upland landfill area.
- The State of Washington Underground Storage Tank Regulations (Chapter 173-360 WAC) establish requirements for the permanent closure of USTs (173-360-385 WAC) which are applicable to in-place closure of the concrete USTs in the Fire Training Area.
- The Kitsap County Shoreline Master Plan (WAC 173-19-2604), as developed pursuant to the State of Washington Shoreline Management Act (Chapter 90.58 RCW) covers fill, dredging, and other remedial activities conducted in Clam Bay within 200 feet of the shoreline.
- State of Washington (WISHA) and Federal (OSHA) requirements are applicable standards establishing safe operating procedures and requirements for the conduct of all remedial actions at the Site. The state regulations are codified in Chapter 296-62 (Part P) WAC.
- The CERCLA Off-Site Disposal Rule, as set forth in an amendment to the NCP, Procedures for Planning and Implementing Offsite Response Actions (40 CFR 300.440), is applicable to off-site disposal actions included in the selected remedy. In addition, RCRA establishes land disposal restrictions (40 CFR Part 268) that must be met before hazardous wastes can be land disposed.
- The State of Washington Minimal Functional Standards (MFS) for Solid Waste Handling (Chapter 173-304 WAC) are relevant and appropriate standards for the design of landfill containment and long-term operations and maintenance requirements within the landfill cap area.
- The State of Washington Hydraulic Code Rules (Chapter 220-110 WAC) contains standards for removal and filling actions waterward of the ordinary high water elevation.
- The Endangered Species Act (16USC 1531-1544) conserves threatened or endangered species.

Other Criteria, Advisories, or Guidance To-Be-Considered (TBC)

- Executive Orders 11990 and 11988 (40 CFR 6, Appendix A), which are intended to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial uses of wetlands and floodplains.
- Requirements and guidelines for evaluating dredged material, disposal site management, disposal site monitoring, and data management established by Puget Sound Dredge Disposal Analysis (PSDDA, 1988 and 1989).
- Critical toxicity values (acceptable daily intake levels, carcinogenic potency factor) and U.S. Food and Drug Administration action levels for concentrations of mercury and PCBs in edible seafood tissue.
- EPA Wetlands Action Plan (EPA, 1989) describing the National Wetland Policy and primary goal of "no net loss."
- Puget Sound Storm Water Management Program (pursuant to 40 CFR Parts 122-24, and RCW 90.48).
- Puget Sound Estuary Program Protocols, (1987) as amended, for sample collection, laboratory analysis, and QA/QC procedures.

12.3 Cost Effectiveness

The selected remedy is cost-effective because it is protective of human health and the environment, achieves ARARs, and its effectiveness in meeting the objectives of the selected remedy is proportional to its cost. Cost-effectiveness was also established in the presumptive remedy for military landfills. Specific risk and cost balances achieved by the selected remedy include the following:

- On-site containment of landfill wastes is more cost-effective and affords the same relative risk reduction as treatment and disposal of wastes in an off-site landfill.

- Implementing effective source controls, including capping of Clam Bay sediments, provides long-term protection at significantly lower cost than sediment dredging and off-site disposal.
- Removing dioxin-impacted soil, which represents the majority of Site risk in the Fire Training Area, and implementing institutional controls to address low risk TPH-impacted soils left in-place, achieve an effective balance of risk reduction and cost.

The selected remedial components are substantially more cost-effective than the alternative components considered, while achieving the same substantive risk reduction.

12.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The Corps and EPA have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for the Manchester Annex Superfund Site.

12.5 Preference for Treatment as Principal Element

The selected remedy uses no treatment technologies except possible incineration of PCB-containing UST residue associated with the Fire Training Area. Given the large volume and nature of the waste at the Site, containment, as a presumptive remedy for the landfill, provides effective protection of human health and the environment at a considerably lower cost than treatment to achieve the same degree of risk reduction.

13.0 DOCUMENTATION OF NO SIGNIFICANT CHANGES

The Corps and EPA released the Manchester Annex Superfund Site Proposed Plan (preferred remedial alternative) for public comment on April 1, 1997. The preferred alternative presented in the proposed plan is the same as the selected alternative presented in this Record of Decision. The Corps and EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of those comments, it was determined that no significant changes to the remedy, as it was originally identified in the proposed plan, were necessary.

14.0 REFERENCES (A)

Corps, 1993. US Army Corps of Engineers - Seattle District Preliminary Assessment: Manchester Field Station, Manchester, Washington. For National Oceanic & Atmospheric Administration, October 1993.

Corps, 1995. US Army Corps of Engineers - Seattle District Chemical Quality Assessment Report. Sediment Sampling Results from NMFS and Corps Sampling in February and March 1994 at Manchester Annex, Manchester, Washington.

Corps, 1997. US Army Corps of Engineers - Seattle District Proposed Plan for Site Cleanup, Manchester Annex Superfund Site, Manchester, Washington March 1997.

Dollarhicle, Joan S., 1992. Oral Reference Doses and Oral Slope Factors for JP-4, JP-5, Diesel Fuel, and Gasoline. Memorandum to Carol Sweendy, U.S. EPA, Region 10, March 24, 1992.

Ecology and Environment, Inc., 1987. Preliminary Assessment of EPA's Region X Manchester Laboratory. Prepared for EPA, April 30, 1987.

Ecology and Environment, Inc., 1988. Site Inspection Report, USEPA Manchester Laboratory, Manchester, Washington, TDD F10-8710-01, For the US EPA.

EPA, 1985. U.S. Environmental Protection Agency, Drinking Water Criteria Document for Copper, EPA 600-X-84-190-1, March 1985.

EPA, 1989. Update of Toxicity Equivalency Factors (TEFs) for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-Dioxins and Dibenzofurans (CDD and CDFs). Risk Assessment Forum, February 1989.

EPA, 1992. Site Investigation of an Old U.S. Navy Dump Site Near Manchester, Washington, September 1992.

EPA, 1993. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons, EPA/600/R-93/089, July 1993.

EPA, 1995a. Integrated Risk Information System. Office of Research and Development, Environmental Criteria and Assessment Office, October 1995 accession.

EPA, 1995b. Health Effects Assessment Summary Tables. Annual FY 1995. EPA Office of Solid Waste and Emergency Response Report No. OS-230.

Hart Crowser, 1994a. Project Management Plan, Manchester Annex Site, Remedial Investigation/Feasibility Study, Site No. F102A011900, Manchester, Washington. October 19, 1994.

Hart Crowser, 1994b. Manchester Fisheries Laboratory, Dioxin and Furan Sampling, Manchester, Washington. Prepared for U.S. Army Corps of Engineers. April 8, 1994.

Hart Crowser, 1995a. Draft Site Characterization Technical Memorandum, Manchester Annex Remedial Investigation/Feasibility Study (SCTM), Site No. F10WA11900, Manchester, Washington. Volumes I, II, and III. July 10, 1995.

Hart Crowser, 1995b. Addendum No. 1 to the Project Management Plan, Manchester Annex Site Remedial Investigation/Feasibility Study, Site No. F10WA11900, Manchester, Washington. September 1, 1995.

Hart Crowser, 1995c. Addendum No. 1 to the SCTM, Draft Site Characterization Technical Memorandum, Manchester Annex Remedial Investigation/Feasibility Study, Site No. F10WA11900, Manchester, Washington. November 6, 1995.

Hart Crowser, 1995d. Addendum No. 2 to the Project Management Plan, Manchester Annex Site Remedial Investigation/Feasibility Study, Site No. F10WA011900, Manchester, Washington. November 22, 1995.

Hart Crowser, 1995e. Evaluation of Early Remedial Action Options Considered and Decision of Implementation, Manchester Annex Remedial Investigation/Feasibility Study, Site F10WA011900. October 27, 1995.

Hart Crowser, 1996. Final Remedial Investigation/Feasibility Study, Manchester Annex Superfund Site, Manchester, Washington. December 1996.

Larson, 1997. Larson Anthropological/Archaeological Services. Cultural Resource Reconnaissance of the EPA's Manchester Laboratory Facility - Manchester Annex Superfund Landfill Site, Kitsap County, Clam Bay, Washington. January 14, 1997.

Oak Ridge National Laboratory, 1994. Manual for PC-Database Screening Benchmarks for Ecological Risk Assessment. ORNL/TM-12898. Oak Ridge National Laboratory, Oak Ridge, Tennessee. December 1994.

Smith, R.L., 1995. Risk-Based Concentration Table, January - June 1995. U.S. Environmental Protection Agency, Region III, Philadelphia, Pennsylvania. March 7, 1995.

Suter, II, C.W., and J.B. Mabrey, 1994, Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Prepared by Environmental Sciences Division, Oak Ridge National Laboratory, July 1994.

(A) This is a partial list of documents used in preparing the Record of Decision. The decision is based on the administrative record for the Site.

Table 1 - Listing of Chemicals of Potential Concern, Manchester Annex Site

Metals	Semivolatile Organics
Antimony	2,4-Dimethylphenol
Arsenic	Di-n-Butylphthalate
Beryllium	
Cadmium	PCBs and Pesticides
Chromium	Total PCBs
Copper	Aldrin
Lead	4,4'-DDT
Manganese	4,4'-DDE
Mercury	4,4'-DDD
Nickel	
Selenium	Dioxins and Furans
Silver	2,3,7,8-TCDD
Thallium	1,2,3,7,8-PeCDD
Vanadium	1,2,3,4,7,8-HxCDD
Zinc	1,2,3,6,7,8-HxCDD
	1,2,3,7,8,9-HxCDD
Miscellaneous Inorganics	1,2,3,4,6,7,8-HpCDD
Asbestos	OCDD
Cyanide	2,3,7,8-TCDF
	1,2,3,7,8-PeCDF
Volatile Organic Compunds	2,3,4,7,8-PeCDF
Vinyl chloride	1,2,3,4,7,8-HxCDF
Benzene	1,2,3,6,7,8-HxCDF
	1,2,3,7,8,9-HxCDF
Polynuclear Aromatic Hydrocarbons (PAHs)	2,3,4,6,7,8-HxCDF
Benzo(a)anthracene	1,2,3,4,6,7,8-HpCDF
Benzo(a)pyrene	1,2,3,4,7,8,9-HpCDF
Benzo(b)fluoranthene	OCDF
Dibenzo(a,h)anthracene	
Fluoranthene	Total Petroleum Hydrocarbons
Indeno(1,2,3-cd)pyrene	As Gasoline
	As Diesel
	As Oil

Table 2 - Summary of Soil Quality Data for Landfill Area

	Detection Frequency	Maximum Detection	Human Health		Plant and Wildlife	
			Screening Level	Exceedence Frequency (1)	Screening Level	Exceedence Frequency (1)
Inorganics in mg/kg						
Cyanide	0/5	ND		1600 0/5		
Total Metals in mg/kg						
Antimony	15/25	415 J		31 9/25	5	14/25
Arsenic	31/31	52.3		7.3 19/31	10	16/31
Beryllium	24/31	2.9		0.61 5/31	10	0/30
Cadmium	25/31	22800		2 21/31	2	21/31
Chromium	31/31	690 N		100 12/31	48	16/31
Copper	31/31	23400		2900 5/31	50	23/31
Lead	30/31	56000		250 16/31	50	21/31
Manganese	20/20	1500 J		1100 1/20		
Mercury	20/31	3.7		7 0/31	0.1	12/29
Nickel	31/31	926 N		1600 0/31	48	17/31
Selenium	3/31	0.85 NE		390 0/31	1	0/14
Silver	19/31	67620		240 1/31	2	15/26
Thallium	0/25	ND		5.6 0/24	1	0/15
Vanadium	20/20	590		550 1/20		
Zinc	31/31	23800		23000 1/31	85	25/31
Volatiles in Ig/kg						
Benzene	5/6	8		500 0/6	40000	0/6
Vinyl Chloride	2/6	280		2 2/6	570	0/6
Semivolatiles in Ig/kg						
2,4-Dimethylphenol	0/15	ND		1600000 0/15		
Benzo(a)Anthracene	4/15	2800		880 1/14		
Benzo(a)Pyrene	4/15	2600 J		88 2/5	1500	1/14
Benzo(b)Fluoranthene	4/15	5300 JX		880 1/14		
Dibenzo(a,h)Anthracene	2/15	930 J		88 2/5		
Di-N-Butylphthalate	4/15	150		100000 0/15	71	1/6
Fluoranthene	7/15	8600		68000 0/15		
Indeno(1,2,3-c,d)Pyrene	3/15	2100 J		880 1/14		
Total cPAHs	6/15	21430		1000 4/7		

Table 2 - Summary of Soil Quality Data for Landfill Area

	Human Health				Plant and Wildlife	
	Detection Frequency	Maximum Detection	Screening Level	Exceedence Frequency (1)	Screening Level	Exceedence Frequency (1)
Pesticide/PCBs in Ig/kg						
4,4'-DDD	3/5	10 J	2700	0/5	0.5	2/3
4,4'-DDE	2/5	160 J	1900	0/5	0.5	2/2
4,4'-DDT	2/5	5.9 J	1000	0/5	0.5	2/2
Aldrin	0/5	ND	38	0/5	670	0/5
Total PCBs	19/27	8900	83	18/22	180	12/26
Dioxins in ng/kg						
2378-TCDD	3/4	110 J	4	3/4		
12378-PeCDD	3/4	241	8	3/4		
123478-HxCDD	3/4	321	40	3/4		
123678-HxCDD	4/4	553	40	3/4		
123789-HxCDD	4/4	922	40	3/4		
1234678-HpCDD	4/4	2140	400	3/4		
OCDD	4/4	4900	4000	2/4		
2378-TCDF	4/4	1440 NC	40	3/4		
12378-PeCDF	4/4	1410	80	3/4		
23478-PeCDF	4/4	1640	80	3/4		
123478-HxCDF	4/4	3270	40	3/4		
123678-HxCDF	4/4	939	40	3/4		
123789-HxCDF	3/4	83.6 J	40	1/4		
234678-HxCDF	4/4	1190	40	3/4		
1234678-HpCDF	4/4	4360	400	3/4		
1234789-HpCDF	3/4	228	400	0/4		
OCDF	3/4	922	4000	0/4		
2378-TCDD Equivalents	4/4	2100				
Total Petroleum Hydrocarbons in mg/kg						
Diesel	5/11	280	200	1/11		
Oil	7/11	2300	200	5/11		

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations

Table 3 - Summary of Soil Quality Data for Fire Training Area

Sheet 1 of 2

	Detection Frequency	Maximum Detection	Human Health		Plant and Wildlife	
			Screening Level	Exceedence Frequency (1)	Screening Level	Exceedence Frequency (1)
Inorganics in mg/kg						
Cyanide	0/9	ND	1600	0/9		
Total Metals in mg/kg						
Antimony	0/9	ND	31	0/9	5	0/9
Arsenic	9/9	12.6	7.3	1/9	10	1/9
Beryllium	1/9	0.55	0.61	0/9	10	0/9
Cadmium	4/9	1.2	2	0/9	2	0/9
Chromium	9/9	21.5 J	100	0/9	48	0/9
Copper	9/9	69.5	2900	0/9	50	2/9
Lead	5/8	113	250	0/8	50	1/8
Mercury	6/9	0.14	7	0/9	0.1	1/9
Nickel	9/9	29	1600	0/9	48	0/9
Selenium	0/9	ND	390	0/9	1	0/0
Silver	0/9	ND	240	0/9	2	0/9
Thallium	4/9	0.27	5.6	0/9	1	0/9
Zinc	9/9	253	23000	0/9	85	1/9
Volatiles in Ig/kg						
Benzene	3/14	72 J	500	0/14	40000	0/14
Vinyl Chloride	0/10	ND	2	0/6	570	0/10
Semivolatiles in Ig/kg						
2,4-Dimethylphenol	0/9	ND	1600000	0/9		
Benzo(a)Anthracene	2/9	210	880	0/9		
Benzo(a)Pyrene	2/9	240	88	1/9	1500	0/9
Benzo(b)Fluoranthene	3/9	690 X	880	0/9		
Dibenzo(a,h)Anthracene	0/9	ND	88	0/9		
Di-N-Butylphthalate	0/9	ND	100000	0/9	71	0/5
Fluoranthene	2/9	350	68000	0/9		
Indeno(1,2,3-c,d)Pyrene	1/9	400	880	0/9		
Total cPAHs	4/9	2529	1000	1/9		

Table 3 - Summary of Soil Quality Data for Fire Training Area

Sheet 2 of 2

			Human Health		Plant and Wildlife	
	Detection Frequency	Maximum Detection	Screening Level	Exceedence Frequency (1)	Screening Level	Exceedence Frequency (1)
Pesticide/PCBs in Ig/kg						
4,4'-DDD	0/9	ND	2700	0/9	0.5	0/0
4,4'-DDE	0/9	ND	1900	0/9	0.5	0/0
4,4'-DDT	0/9	ND	1000	0/9	0.5	0/0
Aldrin	0/9	ND	38	0/9	670	0/9
Total PCBs	2/9	580	83	1/6	180	1/9
Dioxins in ng/kg						
2378-TCDD	2/30	274	4	2/5		
12378-PeCDD	6/30	2590	8	6/18		
123478-HxCDD	7/30	4070	40	5/23		
123678-HxCDD	9/30	28100	40	8/24		
123789-HxCDD	9/30	23000 J	40	7/23		
1234678-HpCDD	29/30	1260000 D	400	15/30		
OCDD	30/30	5820000 JD	4000	14/30		
2378-TCDF	8/30	840	40	5/22		
12378-PeCDF	2/30	266	80	2/21		
23478-PeCDF	6/30	505	80	4/22		
123478-HxCDF	15/30	5060 E	40	9/23		
123678-HxCDF	5/30	444	40	3/21		
123789-HxCDF	1/30	240	40	1/20		
234678-HxCDF	14/30	808	40	4/22		
1234678-HpCDF	22/30	20600	400	5/30		
1234789-HpCDF	8/30	1510	400	2/30		
OCDF	21/30	31900	4000	3/30		
2378-TCDD Equivalents	30/30	26000				
Total Petroleum Hydrocarbons in mg/kg						
Diesel	23/77	15000	200	13/77		
Gasoline	2/9	480	100	1/9		
Oil	20/77	7700	200	18/77		

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

Table 4 - Summary of Soil Quality Data for Net Depot Area

Sheet 1 of 2

	Detection Frequency	Maximum Detection	Human Health		Plant and Wildlife	
			Screening Level	Exceedence Frequency (1)	Screening Level	Exceedence Frequency (1)
Inorganics in mg/kg						
Cyanide	2/3	1	1600	0/3		
Total Metals in mg/kg						
Antimony	0/3	ND	31	0/3	5	0/2
Arsenic	6/6	8.4	7.3	1/6	10	0/6
Beryllium	6/6	0.65	0.61	1/6	10	0/6
Cadmium	5/6	4.7	2	3/6	2	3/6
Chromium	6/6	37	100	0/6	48	0/6
Copper	6/6	71	2900	0/6	50	1/6
Lead	6/6	72	250	0/6	50	2/6
Manganese	3/3	283 J	1100	0/3		
Mercury	5/6	0.31	7	0/6	0.1	1/6
Nickel	6/6	19.5	1600	0/6	48	0/6
Selenium	0/6	ND	390	0/6	1	0/3
Silver	0/6	ND	240	0/6	2	0/6
Thallium	0/6	ND	5.6	0/6	1	0/3
Vanadium	3/3	71	550	0/3		
Zinc	6/6	409	23000	0/6	85	5/6
Volatiles in Ig/kg						
Benzene	0/3	ND	500	0/3	40000	0/3
Vinyl Chloride	0/3	ND	2	0/3	570	0/3
Semivolatiles in Ig/kg						
2,4-Dimethylphenol	0/6	ND	1600000	0/6		
Benzo(a)Anthracene	2/6	170	880	0/6		
Benzo(a)Pyrene	2/6	140	88	1/3	1500	0/6
Benzo(b)Fluoranthene	2/6	410 X	880	0/6		
Dibenzo(a,h)Anthracene	0/6	ND	88	0/3		
Di-N-Butylphthalate	1/6	11 J	100000	0/6	71	0/3
Fluoranthene	2/6	270	68000	0/6		
Indeno(1,2,3-c,d)Pyrene	2/6	100	880	0/6		
Total cPAHs	2/6	1437	1000	1/3		

Table 4 - Summary of Soil Quality Data for Net Depot Area

Sheet 2 of 2

	Human Health				Plant and Wildlife	
	Detection Frequency	Maximum Detection	Screening Level	Exceedence Frequency (1)	Screening Level	Exceedence Frequency (1)
Pesticide/PCBs in Ig/kg						
4,4'-DDD	0/3	ND	2700	0/3	0.5	0/0
4,4'-DDE	0/3	ND	1900	0/3	0.5	0/0
4,4'-DDT	0/3	ND	1000	0/3	0.5	0/0
Aldrin	0/3	ND	38	0/3	670	0/3
Total PCBS	2/3	131	83	½	180	0/3
Dioxins in ng/kg						
2378-TCDD	1/1	0.67 J	4	0/1		
12378-PeCDD	1/1	2.1 J	8	0/1		
123478-HxCDD	1/1	2.05 J	40	0/1		
123678-HxCDD	1/1	11.4 J	40	0/1		
121789-HxCDD	1/1	6.6 J	40	0/1		
1234678-HpCDD	1/1	136	400	0/1		
OCOD	1/1	1620	4000	0/1		
2378-TCDF	1/1	8.69 NC	40	0/1		
12378-PeCDF	0/1	ND	80	0/1		
23478-PeCDF	1/1	4.31 J	80	0/1		
123478-HxCDF	0/1	ND	40	0/1		
123678-HxCDF	1/1	2.79 J	40	0/1		
123789-HxCDF	0/1	ND	40	0/1		
234678-HxCDF	1/1	5.3 J	40	0/1		
1234678-HpCDF	1/1	53 J	400	0/1		
1234789-HpCDF	1/1	2.38 J	400	0/1		
OCDF	1/1	173	4000	0/1		
2378-TCDD Equivalents	1/1	11.26				
Total Petroleum Hydrocarbons in mg/kg						
Diesel	2/3	47	200	0/3		
Oil	2/3	350	200	2/3		

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

Table 5 - Summary of Groundwater Quality Data for Landfill Area (Surficial Fill Unit)

	Detection Frequency	Maximum Detection	Seep Discharge	
			Screening Level (2)	Exceedence Frequency (1)
Total Metals in Ig/L				
Antimony	9/9	125		
Arsenic	6/9	109	36	2/9
Beryllium	1/6	4.2		
Cadmium	5/9	111		
Chromium	7/9	419	50	2/9
Copper	8/9	3130		
Lead	7/9	2280		
Manganese	3/3	2710		
Mercury	3/9	1.6	0.025	3/3
Nickel	9/9	716		
Selenium	0/3	ND	71	0/3
Silver	7/9	28.8*	1.2	4/9
Thallium	2/6	1.9		
Zinc	9/9	24100		
Dissolved Metals in Ig/L				
Antimony	13/13	33.3		
Arsenic	4/13	14.8 J	36	0/13
Beryllium	0/10	ND		
Cadmium	3/13	13.1	8	1/13
Chromium	6/13	5.6	50	0/13
Copper	10/13	179	10.6	4/13
Lead	6/13	7.2	5.8	1/13
Manganese	3/3	2010		
Mercury	0/13	ND	0.025	0/0
Nickel	9/13	252 J	7.9	6/13
Selenium	0/3	ND	71	0/3
Silver	4/13	1.6	1.2	1/13
Thallium	1/10	1		
Zinc	11/13	5740	77	6/13
Volatiles in Ig/L				
Benzene	3/3	22	700	0/3
Vinyl Chloride	0/3	ND		
Pesticide/PCBs in Ig/L				
PCB-1254	0/3	ND	0.03	0/0
PCB-1260	0/3	ND	0.03	0/0
Total PCBs	0/3	ND	0.03	0/0
Total Petroleum Hydrocarbons in mg/L				
Diesel	8/12	1.1	1	1/12
Gasoline	3/3	1.3	1	1/3
Oil	0/12	ND	1	0/12

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

(2) Seep discharge screening level based on protection of marine aquatic life.

Table 6 - Summary of Groundwater Quality Data for Outwash Channel Aquifer

Sheet 1 of 3

	Detection Frequency	Maximum Detection	Drinking Water		Seep Discharge	
			Screening Level	Exceedence Frequency (1)	Screening Level(2)	Exceedence Frequency (1)
Inorganics in Ig/L						
Cyanide	0/5	ND	200	0/5	1	0/5
Total Metals in Ig/L						
Antimony	1/5	1.2	6	0/5		
Arsenic	4/5	14.5	5	4/5	36	0/5
Beryllium	0/5	ND	0.016	0/0		
Cadmium	0/5	ND	5	0/5		
Chromium	4/5	40.2	80	0/5	50	0/5
Copper	5/5	39	590	0/5		
Lead	4/5	8.1	5	1/5		
Mercury	0/5	ND	2	0/5	0.025	0/0
Nickel	4/5	37.8	100	0/5		
Selenium	1/5	91.1 J	50	1/5	71	1/5
Silver	2/5	0.51	80	0/5		
Thallium	0/5	ND	1.1	0/5		
Zinc	2/5	83.7	4800	0/5		
Dissolved Metals in Ig/L						
Antimony	0/5	ND	6	0/5		
Arsenic	4/5	14.5	5	4/5		
Beryllium	0/5	ND	0.016	0/0		
Cadmium	0/5	ND	5	0/5	8	0/5
Chromium	2/5	12.9	80	0/5		
Copper	5/5	13.6	590	0/5	10.6	1/5
Lead	3/5	1.2	5	0/5	5.8	0/5
Mercury	0/5	ND	2	0/5		
Nickel	4/5	21.2	100	0/5	7.9	2/5
Selenium	1/5	55.9 J	50	1/5		
Silver	0/5	ND	80	0/5	1.2	0/5
Thallium	0/5	ND	1.1	0/5		
Zinc	0/5	ND	4800	0/5	77	0/5

Table 6 - Summary of Groundwater Quality Data for Outwash Channel Aquifer

Sheet 2 of 3

	Detection Frequency	Maximum Detection	Drinking Water		Seep Discharge	
			Screening Level	Exceedence Frequency (1)	Screening Level(2)	Exceedence Frequency (1)
Volatiles in Ig/L						
Benzene	0/10	ND	0.36	0/0	700	0/10
Vinyl Chloride	0/10	ND	0.019	0/0		
Semivolatiles in Ig/L						
2,4-Dimethylphenol	0/5	ND	320	0/5		
Benzo(a)Anthracene	0/9	ND	0.092	0/4	300	0/9
Benzo(a)Pyrene	0/9	ND	0.0092	0/0	300	0/9
Benzo(b)fluoranthene	0/9	ND	0.092	0/4	300	0/9
Dibenzo(a,h)Anthracene	0/9	ND	0.0092	0/0	300	0/9
Di-N-Butylphthalate	0/5	ND	1600	0/5		
Fluoranthene	0/9	ND	640	0/9	300	0/9
Indeno(1,2,3-c,d)Pyrene	1/9	0.01 J	0.092	0/4	300	0/9
Totals CPHAs	1/9	0.1265	0.1	1/1		
Pesticide/PCBs in Ig/L						
4,4'-DDD	0/5	ND	0.28	0/5	0.001	0/0
4,4'-DDE	0/5	ND	0.2	0/5	0.001	0/0
4,4'-DDT	0/5	ND	0.2	0/5	0.001	0/0
Aldrin	0/5	ND	0.004	0/5	0.0019	0/0
PCB-1254	0/5	ND	0.0087	0/0	0.03	0/0
PCB- 1260	0/5	ND	0.0087	0/0	0.03	0/0
Total PCBs	0/5	ND	0.0087	0/0	0.03	0/0
Dioxins in ng/L						
2378-TCDD	0/9	ND	0.0004	0/0	9E-06	0/0
12378-PeCDD	0/9	ND	0.0008	0/0	1.7E-05	0/0
123478-HxCDD	0/9	ND	0.004	0/3	8.6E-05	0/0
123678-HxCDD	0/9	ND	0.004	0/3	8.6E-05	0/0
123789-HxCDD	0/9	ND	0.004	0/3	8.6E-05	0/0
1234678-HpCDD	5/9	0.029 J	0.04	0/5	0.00086	5/5
OCDD	6/9	151	0.4	1/6	0.00864	6/6
2378-TCDF	0/9	ND	0.004	0/5	8.6E-05	0/0
12378-PeCDF	0/0	ND	0.008	0/5	0.00017	0/0

Table 6 - Summary of Groundwater Quality Data for Outwash Channel Aquifer

Sheet 3 of 3

	Detection Frequency	Maximum Detection	Drinking Water		Seep Discharge	
			Screening Level	Exceedence Frequency (1)	Screening Level(2)	Exceedence Frequency (1)
23478-PeCDF	0/9	ND	0.008	0/9	1.7E-05	0/0
Dioxins in ng/L						
123478-HxCDF	1/9	0.004 J	0.004	0/4	8.6E-05	1/1
123678-HxCDF	1/9	0.003 J	0.004	0/5	8.6E-05	1/1
123789-HxCDF	0/9	ND	0.004	0/3	8.6E-05	0/0
234678-HxCDF	3/9	3.6	0.004	2/6	8.6E-05	3/3
1234678-HpCDF	1/9	0.006 J	0.04	0/5	0.00086	1/1
1234789-HpCDF	0/9	ND	0.04	0/5	0.00086	0/0
OCDF	2/9	0.012 J	0.4	0/5	0.00864	1/5
2378-TCDD Equivalents	6/6	0.36				
Total Petroleum Hydrocarbons in mg/L						
Diesel	5/15	0.59	1	0/15	1	0/15
Oil	0/15	ND	1	0/15	1	0/15

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

(2) Seep discharge screening level based on protection of marine aquatic life.

Table 7 - Summary of Seep Quality Data for Landfill Area

Sheet 1 of 2

	Detection Frequency	Maximum Detection	Seep Discharge	
			Screening Level (2)	Exceedence Frequency (1)
Inorganics in Ig/L				
Cyanide	½	5	1	1/1
Total Metals in Ig/L				
Antimony	12/16	20.3		
Arsenic	0/16	N/A	36	0/16
Beryllium	0/12	N/A		
Cadmium	8/16	4.4 J		
Chromium	11/16	7.3	50	0/16
Copper	16/16	354		
Lead	14/16	56.3		
Manganese	4/4	230		
Mercury	1/16	0.13 P	0.025	1/1
Nickel	8/12	46.7		
Selenium	1/7	51.8	71	0/7
Silver	10/16	2.1		
Thallium	4/12	6.6 J		
Vanadium	3/4	42 P		
Zinc	15/16	240		
Dissolved Metals in Ig/L				
Antimony	12/12	17.7		
Arsenic	0/12	N/A		
Beryllium	0/8	N/A		
Cadmium	7/12	4.2 J	8	0/12
Chromium	11/12	4.1		
Copper	12/12	21.3	10.6	8/12
Lead	3/12	1	5.8	0/12
Mercury	2/12	0.59		
Nickel	8/8	47.3	7.9	6/8
Selenium	1/3	51.8 J		
Silver	7/12	0.78 J	1.2	0/12
Thallium	5/8	3.6		
Zinc	9/12	232	77	3/12
Volatiles in Ig/L				
Benzene	0/2	N/A		
Vinyl Chloride	0/2	N/A		

Table 7 - Summary of Seep Quality Data for Landfill Area

Sheet 2 of 2

	Detection Frequency	Maximum Detection	Seep Discharge	
			Screening Level (2)	Exceedence Frequency (1)
Semivolatiles in Ig/L				
2,4-Dimethylphenol	0/2	N/A		
Benzo(a)Anthracene	0/2	N/A	300	0/2
Benzo(a)Pyrene	0/2	N/A	300	0/2
Benzo(b)Fluoranthene	0/2	N/A	300	0/2
Dibenzo(a,h)Anthracene	0/2	N/A	300	0/2
Di-N-Butylphthalate	0/2	N/A		
Fluoranthene	0/2	N/A	300	0/2
Indeno(1,2,3-c,d)Pyrene	0/2	N/A	300	0/2
Total CPAHs	0/2	N/A		
Pesticide/PCBs in Ig/L				
4,4'-DDD	0/7	N/A	0.001	0/0
4,4'-DDE	0/7	N/A	0.001	0/0
4,4'-DDT	0/7	N/A	0.001	0/0
Aldrin	0/7	N/A	0.0019	0/0
PCB-1254	3/17	0.12	0.03	3/3
PCB-1260	1/17	0.11	0.03	1/1
Total PCBs	3/17	0.12	0.03	3/3
Total Petroleum Hydrocarbons in mg/L				
Diesel	0/13	N/A	1	0/13
Gasoline	0/1	N/A	1	0/1
Oil	0/12	N/A	1	0/12

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

(2) Seep discharge screening level based on protection of marine aquatic life.

Table 8 - Summary of Surface Water and Seep Quality Data for Fire Training Area

			Seep Discharge	
	Detection Frequency	Maximum Detection	Screening Level (2)	Exceedence Frequency (1)
Volatiles in Ig/L				
Benzene	0/1	ND		
Vinyl Chloride	0/1	ND		
Pesticide/PCBs in Ig/L				
PCB-1254	0/2	ND	0.03	0/0
PCB-1260	0/2	ND	0.03	0/0
Total PCBs	0/2	ND	0.03	0/0
Total Petroleum Hydrocarbons in mg/L				
Diesel(3)	1/9	5.2 D	1	1/9
Gasoline	0/3	ND	1	0/3
Oil	0/7	ND	1	0/7

- (1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.
- (2) Seep discharge screening level based on protection of marine aquatic life.
- (3) The only exceedence was a detection of diesel associated with discharge from a drain pipe to a pond in the southern portion of the Fire Training Area.

Table 9 - Summary of Surface Water and Seep Quality Data for Net Depot Area

	Detection Frequency	Maximum Detection	Seep Discharge	
			Screening Level (2)	Exceedence Frequency (1)
Inorganics in Ig/L				
Cyanide	2/4	10.8	1	2/2
Total Metals in Ig/L				
Antimony	4/4	5.2 J		
Arsenic	0/4	ND	36	0/4
Beryllium	0/4	ND		
Cadmium	1/4	3.3 J		
Chromium	4/4	8.4	50	0/4
Copper	4/4	8.4 J		
Lead	2/4	1.1		
Mercury	0/4	ND	0.025	0/0
Nickel	4/4	10.9 J		
Selenium	0/4	ND	71	0/4
Silver	2/4	1.3 J		
Thallium	2/4	10.9 J		
Zinc	3/4	70.4		
Dissolved Metals in Ig/L				
Antimony	4/4	3.6 J		
Arsenic	0/4	ND		
Beryllium	0/4	ND		
Cadmium	1/4	3.4 J	8	0/4
Chromium	3/4	3.3 J		
Copper	4/4	30.6	10.6	1/4
Lead	0/4	ND	5.8	0/4
Mercury	0/4	ND		
Nickel	4/4	11.2 J	7.9	1/4
Selenium	0/4	ND		
Silver	2/4	0.67	1.2	0/4
Thallium	3/4	7 J		
Zinc	3/14	53.6	77	0/4
Volatiles in Ig/L				
Benzene	0/4	ND		
Vinyl Chloride	0/4	ND		
Semivolatiles in Ig/L				
2,4-Dimethylphenol	0/4	ND		
Benzo(a)Anthracene	0/4	ND	300	0/4
Benzo(a)Pyrene	0/4	ND	300	0/4
Benzo(b)Fluoranthene	0/4	ND	300	0/4
Dibenzo(a,h)Anthracene	0/4	ND	300	0/4
Di-N-Butylphthalate	0/4	ND		

Table 9 - Summary of Surface Water and Seep Quality Data for Net Depot Area

Sheet 2 of 2

	Detection Frequency	Maximum Detection	Screening Level (2)	Seep Discharge Exceedence Frequency (1)
Fluoranthene	0/4	ND	300	0/4
Indeno(1,2,3-c,d)Pyrene	0/4	ND	300	0/4
Total cPAHs	0/4	ND		
Pesticide/PCBs in Ig/L				
4,4'-DDD	0/4	ND	0.001	0/0
4,4'-DDE	1/4	0.0021	0.001	1/1
4,4'-DDT	1/4	0.0032	0.001	1/1
Aldrin	0/4	ND	0.0019	0/0
PCB-1254	0/4	ND	0.03	0/0
PCB-1260	0/4	ND	0.03	0/0
Total PCBs	0/4	ND	0.03	0/0
Total Petroleum Hydrocarbons in mg/L				
Diesel	0/4	ND	1	0/4
Oil	0/4	ND	1	0/4

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

(2) Seep discharge screening level based on protection of marine aquatic life.

Table 10 - Summary of Sediment Quality Data for Clam Bay
Sheet 1 of 2

	Detection Frequency	Maximum Detection	Screening Level	Exceedence Frequency (1)
Total Metals in mg/kg				
Antimony	23/68	41.5		
Arsenic	77/78	56.5	57	0/78
Beryllium	22/23	0.4 P		
Cadmium	52/78	8.35	5.1	2/78
Chromium	76/78	184.2 J	260	0/78
Copper	76/78	19400	390	6/78
Lead	70/78	1510	450	4/78
Manganese	16/16	703		
Mercury	59/77	0.489	0.41	3/77
Nickel	23/23	494		
Selenium	0/23	N/A		
Silver	23/78	3.5 N	6.1	0/78
Thallium	6/23	0.33 J		
Vanadium	16/16	111		
Zinc	78/78	3100	410	15/78
Semivolatiles in mg/kg OC				
Benzo(a)Anthracene	14/27	37.975	110	0/27
Benzo(a)Pyrene	12/27	27.848	99	0/27
Di-N-Butylphthalate	2/17	19 J	220	0/17
Dibenzo(a,h)Anthracene	1/27	7.468	12	0/27
Fluoranthene	21/27	167.5	160	1/27
Indeno(1,2,3-c,d)Pyrene	10/27	24.051	34	0/27
Total Benzofluoranthenes	15/27	70.89	230	0/27
Semivolatiles in Ig/kg				
2,4-Dimethylphenol	1/17	92	29	1/17
Pesticide/PCBs in Ig/kg				
4,4'-DDD	4/17	6.4 J		
4,4'-DDE	6/17	2		
4,4'-DDT	5/17	170		
Aldrin	1/17	0.4		
Total PCBs	68/93	6470	130	23/92
Dioxins in mg/kg				
2378-TCDD	4/7	2.7 J		
12378-PeCDD	3/5	7.5 J		
123478-HxCDD	2/5	5.3 J		
123678-HxCDD	3/5	18 J		
123789-HxCDD	4/5	188 J		
1234678-HpCDD	8/8	103		
OCDD	9/9	1760		

	Detection Frequency	Maximum Detection	Screening Level	Exceedence Frequency (1)
2378-TCDF	4/5	23.3		
12378-PeCDF	4/5	18.8 J		
23478-PeCDF	4/5	33.5		
123478-HxCDF	4/5	83.8		
123678-HxCDF	4/5	27.1 J		
123789-HxCDF	3/5	1.4 J		
234678-HxCDF	5/5	37.2 J		
1234678-HpCDF	5/5	109		
1234789-HpCDF	3/5	7.5 J		
OCDF	5/5	94.3		
2378-TCDD Equivalents	9/9	51		

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

Table 11 - Summary of Tissue Quality Data for Clam Bay

	Detection Frequency	Maximum Detection	Screening Level	Exceedence Frequency
(1)				
Total Metals in mg/kg				
Antimony	0/7	ND	0.54	
Arsenic	14/14	16	4.5	1/14
Beryllium	0/7	ND	0.0007	0/0
Cadmium	13/14	0.5	0.68	0/14
Chromium	10/14	1.6	6.8	0/14
Copper	14/14	76.16 J	50	1/14
Lead	10/14	3.4882 J		
Manganese	14/14	211	6.8	2/14
Mercury	9/14	0.0544 J	0.41	0/14
Nickel	13/14	2	27	0/14
Selenium	10/14	6	6.8	0/14
Silver	13/14	1.2 J	6.8	0/14
Thallium	0/7	ND	0.11	0/1
Zinc	14/14	53.9	410	0/14
Semivolatiles in Ig/kg				
2,4-Dimethylphenol	0/7	ND	27	0/0
Benzo(a)Anthracene	9/16	21.42	4.3	1/9
Benzo(a)Pyrene	9/16	6.174	0.59	6/9
Benzo(b)Fluoranthene	9/16	10.458	4.3	1/19
Dibenzo(a,h)Anthracene	7/16	0.504	0.43	1/9
Di-,N-Butylphthalate	0/7	ND		
Fluoranthene	11/16	75.6	54000	0/16
Indeno(1,2,3-c,d)Pyrene	9/16	3.024	4.3	0/9
Pesticide/PCBs in Ig/kg				
4,4'-DDD	4/16	3.422	13	0/15
4,4'-DDE	9/16	7.198	9.3	0/16
4,4'-DDT	5/16	36	9.3	1/16
Aldrin	0/16	ND	0.24	0/6
Total PCBs	13/16	656.727	14	13/13
Dioxins in ng/kg				
2378-TCDD	2/5	0.48	0.09	2/4
12378-PeCDD	0/4	ND	0.04	0/0
123478-HxCDD	0/4	ND	0.2	0/4
123678-HxCDD	1/4	0.81	0.69	1/4
123789-HxCDD	0/4	ND	0.2	0/4
1234678-HpCDD	5/6	4.9	2.5	2/6
OCDD	6/6	31.5	20	2/6
2378-TCDF	4/4	0.86	0.79	1/4
12378-PeCDF	0/4	ND	0.4	0/4
23478-PeCDF	1/4	0.62	0.4	1/4
123478-HxCDF	1/4	0.57	0.2	1/4
123678-HxCDF	0/4	ND	0.2	0/2
123789-HxCDF	0/4	ND	0.2	0/4
234678-HxCDF	1/4	0.17	0.23	0/4
1234678-HpCDF	2/4	1.2	2	0/4
1234789-HpCDF	0/4	ND	2	0/4
OCDF	1/4	1.9	20	0/4
2378-TCDD Equivalents	6/6	0.69		

(1) Undetected sample results with quantitation limits greater than screening levels were excluded from exceedence frequency calculations.

Table 12 - Maximum Concentrations Detected in Site Media

Chemical of Concern	Maximum Detected Soil Concentration in mg/kg	Maximum Detected Sediment Concentration in mg/kg	Maximum Detected Groundwater Concentration (a) in ug/L	Maximum Detected Seep Concentration in ug/L	Maximum Detected Shellfish Tissue Concentration in ug/kg (wet weight)
INORGANICS:					
Arsenic	52.3	56.5	109	ND	16000
Asbestos	(b)	NA	NA	NA	NA
Cadmium	22800	8.35	13.1(c)	4.2 J(c)	500
Copper	23400	19400	179(c)	30.6(c)	76200 J
Lead	56000	1510	7.2(c)	1(c)	3490 J
Nickel	926	494	252(c)	47.3(c)	2000
Silver	67600	5.5	1.6(c)	0.78 J(c)	1200 J
Zinc	23800	3100	5740(c)	232(c)	53900
ORGANICS:					
Vinyl Chloride	0.28	NA	ND	ND	NA
2,4-Dimethylphenol	ND	0.092	ND	ND	ND
Total PCBs	8.9	6.47	ND	0.12	660
2,3,7,8-TCDD Equiv.	0.026	0.000051	0.00036(d)	NA	0.00069
TPH(as diesel)	15000	NA	1100	ND	NA

J Estimated concentration.

NA Not analyzed.

ND Not detected

Notes:

(a) Groundwater samples collected from the landfill area unless otherwise noted

(b) Two samples collected from test pits in the landfill area contained 75 to 80 percent fibrous asbestos. Asbestos was not observed in any other site areas.

(c) Dissolved concentration.

(d) Groundwater sample collected from the Outwash Channel Aquifer.

Table 13 - TPH Soil-to-Leachate Ratios in Fire Training Area

Sample ID	Sample Depth in Feet	TPH Soil Conc. in mg/kg	TPH SPLP Conc. in mg/L	Soil/Leachate Ratio Unitless
94MAN001B10	0 to 2.5	7,970	1.25 UJ	>6,376
94MAN002B11	2.5 to 5	13,990	2 J	6,995
94MAN002B13	2.5 to 5	10,700	2	5,350
94MAN002B14	2.5 to 5	15,840	2.5 UJ	>6,336
94MAN003B12	5 to 7.5	1,140	1.13 J	1,009
94MAN003B13	5 to 7.5	11,650	2.7	4,315

Notes:

* TPH is sum of diesel and oil fractions

> Soil-to-Leachate ratio is minimum value, based on nondetected leachate concentration

UJ = Not detected at estimated detection limit indicated

J = Estimated value

Table 14 - Summary of Cumulative Baseline Cancer Risks and Hazard Indices, Manchester Annex Site

Exposure Scenario	Cancer Risk		Hazard Index	
	Average Exposure	Reasonable Maximum Exposure	Average Exposure	Reasonable Maximum Exposure
On-Site Worker	4.E-06	9.E-04	0.4	260
Occasional Site Visitor(Child)	-	1.E-03	-	1,000
Subsistence Fisher	2.E-05	6.E-05	0.7	3

Table 15 - Summary of Manchester Annex Cleanup Levels and Cleanup Goals

Chemical of Concern	Cleanup Level	Basis	Cleanup Goal	Basis	Point of Compliance
Landfill Area - Seeps					
Copper	10.6 ug/L	Regional background			Seep Discharge
Nickel	7.9 ug/L	WAC 173-201A marine chronic			Seep Discharge
Zinc	77 ug/L	WAC 173-201A marine chronic			Seep Discharge
Total PCBs	0.03ug/L	WAC 173-201A marine chronic			Seep Discharge
Clam Bay - Sediments					
Copper	390 mg/kg dry	WAC 173-204 SQS			0 to 10 cm depth
Lead	450 mg/kg dry	WAC 173-204 SQS			0 to 10 cm depth
Silver	6.1 mg/kg dry	WAC 173-204 SQS			0 to 10 cm depth
Zinc	410 mg/kg dry	WAC 173-204 SQS			0 to 10 cm depth
2,4-Dimethylphenol	29 ug/kg dry	WAC 173-204 SQS			0 to 10 cm depth
Total PCHs	130 ug/kg dry	Lowest AET (Ecology, 1988)	40 ug/kg dry	Bioaccumulation correlation (est.)	0 to 10 cm depth
Clam Bay - Tissue					
Total PCBs	N/A(b)		42 ug/kg wet(c)	Subsistence fishing	Intertidal clams
Fire Training Area - Soil					
2,3,7,8-TCDD Equiv.	270 ng/kg	WAC 173-340 Method C			0 to 15 ft depth
TPH(as diesel)	N/A(d)		200 mg/kg	WAC 173-340 Method A	

NOTES:

- a) Insufficient toxicity data are available to derive a reliable sediment cleanup level for nickel (reduction of nickel concentrations will result from attainment of other chemical cleanup levels).
- b) Existing (baseline) site concentrations are at or below risk-based cleanup levels except for the subsistence fishing scenario.
- c) A tissue PCB cleanup goal of 42 ug/kg wet weight is associated with a cumulative cancer risk of 1 x 10 ⁻⁵ for a subsistence fishing scenario. Risks associated with subsistence fishing can be controlled by implementing temporary limitations on subsistence-level consumption during the initial recovery period.
- d) Site-specific risk assessment and leachability testing indicated only a low risk associated with TPH; consequently, no chemical-specific cleanup level is necessary.

Table 16 - Estimated Areas and Volumes Exceeding Soil and Sediment Cleanup Levels

Description	Area in sq ft (4)	Average Depth in Feet	Volume in CY (4)
Landfill and Clam Bay (1)			
Landfill debris and cap material	270,000	7	70,000
Silt basin offshore of north end of landfill	2,700	8	800
Intertidal surficial sediments	210,000	0.5	3,900
Fire Training Area (2)			
Debris inside simulators	2,600	2	190
Dioxin-impacted surficial soil around simulators	3,200	1	120
Debris/soil pile north of main simulator complex	830	4	120
Soil at main simulator complex exceeding cleanup goal for TPH (3)	30,000	8	8,800
Soil at former fire training stations and UST exceeding cleanup goal for TPH (3)	3,400	4	500
Net Depot and Manchester State Park			
Complies with soil and sediment cleanup levels			

(1) Soil and sediment areas exceeding cleanup levels in the landfill area and Clam Bay are shown on Figure 7.

(2) Soil areas exceeding cleanup levels and cleanup goals in the Fire Training Area are shown on Figure 8.

(3) No cleanup level has been established for TPH.

(4) Area and volume estimates are provided to two significant figures.

ATTACHMENT A

RESPONSIVENESS SUMMARY

INTRODUCTION

This Responsiveness Summary addresses comments on the Proposed Plan for Site Cleanup, Manchester Annex Superfund Site, Manchester, Washington, dated March 1997. The public comment period for the Proposed Plan was from April 2 to May 2, 1997, and a Public Meeting was held on April 16, 1997, at the Manchester Public Library in Manchester, Washington. In addition, two briefings were held at the Manchester Environmental Laboratory on March 31, 1997, for employees of EPA, the Washington State Department of Ecology, and the National Marine Fisheries Service, who work at the site. Questions and comments received during both the employee briefings and the public comment period are addressed in this responsiveness summary.

SUMMARY OF COMMENTS

In total, 54 comments were submitted to the Corps concerning the Proposed Plan. Comments were received from the following sources:

- Three verbal comments were received during the Public Meeting;
- One written comment was submitted on the comment form which accompanied the Proposed Plan;
- Twenty-one verbal comments were received during the two employee briefings held at the Manchester Environmental Laboratory;
- Two verbal comments were received by phone from Washington State offices; and
- Twenty-seven written comments were submitted by three branches of EPA:
 - ▶ Nine comments from the Director of EPA's Facilities Management and Services Division (FMSD);
 - ▶ Eleven comments from the Director of the EPA Manchester Laboratory; and
 - ▶ Seven comments from the Director of EPA's Office of Management Programs (OMP).

Copies of the transcripts for the Public Meeting are available at the public repositories listed in the Community Participation section of the Record of Decision, and a copy is part of the Administrative Record. Copies of the letters received and conversation records have been included in the Administrative Record.

RESPONSE TO COMMENTS

The comments and accompanying responses are arranged under the following eight topics:

1. Remedial Action Preferences
2. Health and Safety Concerns
3. Environmental Concerns
4. Remedial Design Issues
5. Remedial Action Implementation Issues
6. Post-Remedial Operation, Maintenance, and Monitoring Issues
7. Coordination with Other Agencies/Programs
8. Other Issues

Those comments which apply to more than one topic appear under the heading considered the most appropriate. Public comments are addressed first within each topic. Paraphrasing was used to incorporate related concerns expressed in more than one comment. Every attempt has been made to accurately represent and to respond to all comments received.

1. Remedial Action Preferences

Comment 1a. [Public Meeting] I'm Richard Brooks with the Suquamish Tribe. We support the preferred alternative, Alternative 3A.

Response: Comment noted.

Comment 1b. [Mail-in] I prefer the Alternative 3A for the Landfill & Clam Bay sediments and Alternative 2B for the Fire Training Area.

Response: Comment noted.

Comment 1c. [C. Hossum, Agency for Toxic Substances and Disease Registry] I just got a copy of the proposed plan for cleanup at Manchester dated March '97, and it looks great. It looks like a wonderful idea to get the information out, too. As far as the plan goes, I have no problem with it. I think the preferred alternatives are fine from our stand point.

Response: Comment noted.

Comment 1d. [EPA OMP] I concur with the recommendation of cleanup alternative 3A for the landfill and Clam Bay sediments and cleanup alternative 2B for the Fire Training Area. It must be emphasized, however, that regardless of the remediation undertaken, the final ratification will be the monitoring results for the site. If the proposed alternative does not result in the site being judged acceptable within existing environmental parameters, further remediation will have to be undertaken by the Department of Defense or the U.S. Army Corps of Engineers.

Response: Comment noted.

2. Health and Safety Concerns

Comment 2a. [Employee Briefing] A lot of us are concerned about the health and safety of the employees working at the laboratory as well as the potential contamination problems we may have inside the laboratory during the excavation and movement of the shoreline debris. Do you plan to prepare a site safety and health plan that will address these concerns?

Response: A Site Safety and Health Plan (SSHP) will be prepared by the construction contractor. The design will require the contractor to consider these factors in his SSHP submittal.

Comment 2b. [Employee Briefing] What do you plan to do to reduce or eliminate the off-gassing of the vinyl chloride and other volatile materials during the excavation and spreading of the sediments and soils on the landfill?

Response: Vinyl chloride was only detected at very low concentrations (maximum concentration of 0.28 parts per million) in a couple of areas of the upland landfill. Volatile materials are not expected to be a problem at the toe of the landfill because of the high energy environment. And only low concentrations would be expected in the upland landfill, because of the age of the landfill. The SSHP prepared by the construction contractor will address air monitoring during construction activities.

Comment 2c. [Employee Briefing] Is there any danger if someone walks around the landfill now?

Response: No. Risks are minor unless someone digs down below the existing soil cap that the Navy placed over the landfill. As a precaution, the EPA Lab has posted the landfill area with "Keep Out" signs.

Comment 2d. [Employee Briefing] How close is the contaminated area to the laboratory buildings?

Response: The nearest portion of the landfill is about 150 to 200 feet from the office building.

Comment 2e. [Employee Briefing] I have a concern about enforcement of the restriction on subsistence shellfish harvesting. I think that in reality it will be difficult to tell whether someone is a recreational or a subsistence harvester.

Response: Results of the baseline risk assessment performed for the site indicate that potential health risks associated with subsistence-level consumption of shellfish collected from the intertidal area of Clam Bay are above levels targeted by the state cleanup program. The amount of shellfish consumed by the subsistence-level harvester was assumed in the risk assessment to be approximately 23 kg (or about 150 meals) per year. There is currently a restriction on both recreational and subsistence-level shellfish harvesting in Clam Bay. However, if the restriction were not in place, it is unlikely that current conditions in the

intertidal area could support this high level of shellfish harvesting. The Suquamish Tribe has preliminary plans to conduct shellfish enhancement activities at the site after completion of construction activities. A restriction on subsistence-level shellfish harvesting will remain in-place after remedial construction, until the Washington State Department of Health and the Suquamish Tribe determine that the shellfish are safe for subsistence-level harvesting. The Suquamish Tribe will be responsible for enforcing this restriction.

Comment 2f. [EPA Manchester Lab] Our primary concern is for the health and safety of the employees and contractors who work at the laboratory facility and how they will be protected during the cleanup activities. Besides a strong moral commitment, we are required by law to provide a safe and healthful workplace for these employees. A critical part of the cleanup will be the design and implementation of the site safety and health plan for this project. We request that the U.S. Army Corps of Engineers and their contractors work closely with us in designing this plan so that the work can be accomplished without exposing the laboratory workers to asbestos fibers, harmful dusts and vapors, noise or other hazards. The close proximity of the landfill to our facility creates special exposure problems and we want to advise, review and concur on the site safety and health plan before the cleanup project begins.

Response: The health and safety of contractors and site employees is of utmost concern to the Corps and the Superfund program. The EPA Lab will be given opportunity to provide input, review, and comment on the Site Safety and Health Plan before construction activities begin.

Comment 2g. [EPA Manchester Lab] The site safety and health plan should include a comprehensive air and noise monitoring scheme that includes real-time as well as standard industrial hygiene monitoring of these hazards. The shoreline area contains substantial quantities of asbestos debris as well as metals, PCBs, and other contaminants. We are concerned about the potential generation of asbestos fibers and harmful dusts during the cleanup work. The fresh air intake that supplies air to the laboratory is located on the south side of the laboratory mechanical room and the ventilation pumps and air intakes for the Office Building are located on top of this structure. Both of these fresh air intakes are located close to the old landfill. What type of dust controls will be used to control the generation of particulate during the construction activities? Will provisions be made to monitor for particulate at these locations and contingencies implemented to stop work if airborne levels exceed agreed to action levels?

Response: Specific dust control measures will be presented in a Remedial Action Management Plan (RAMP), which will be developed by the Corps and approved by EPA prior to site work. The EPA Lab will be given opportunity to review, comment, and provide input to the RAMP. Examples of dust control measures which may be used include the following:

- 1) Spraying with water or oil/water emulsion to control dust.
- 2) Speed limits for trucks on site to minimize dust generation.
- 3) Sequencing or phasing of work to minimize generation of dust.

A real-time air monitoring program will be instituted to monitor dust levels. Contingencies will be in place to stop or modify work if dust exceeds agreed upon action levels. The dust action levels and required construction actions will be described in detail in the RAMP. Asbestos and other landfill contaminants will be addressed in the construction monitoring plan.

Comment 2h. [EPA OMP] We want to ensure that neither the health of our employees nor the quality of our lab analyses is compromised. The fresh air intakes for our lab are situated on top of the building in such close proximity to the remediation site that it would be advisable for US Corps to undertake monitoring at the fresh air intake and inside the lab.

Response: See response to Comment 2g. The merits of monitoring at the fresh air intakes and/or inside the lab will be considered during development of the RAMP. Monitoring immediately downwind of construction activities will be a key component of the monitoring program, since particulate concentrations will be highest close to the source.

3. Environmental Concerns

Comment 3a. (Public Meeting] I'm Ann Boeholt with the Department of Fish & Wildlife. My comment is that the comment was made that mitigation is not going to be required with the preferred alternative for the toe of the landfill. I would like to say that, from our standpoint that has not been ascertained as of yet; it sounds like, for one, that there may still be some armoring required of the bank. And certainly, even though there would be excavation rather than simply capping what's there, the excavation will cause disturbance of the existing toe and so there may be mitigation. Not to the extent that there would be with Alternative 2A.

Response: Comment noted. The objective of this alternative is to minimize the impact to the aquatic habitat and maximize long-term beach stability. This alternative was selected, following extensive input and discussion by the Manchester Work Group, to avoid the need for mitigation measures included in other alternatives considered. We will continue to coordinate with the Work Group (of which WDFW is a member) throughout design and construction to achieve the remedial action goals, including no net loss of habitat

function.

Comment 3b. [Employee Briefing] Can you discuss some mitigation ideas for the landfill wetlands? Would it be possible to do the mitigation in Beaver Creek above the Navy pond?

Response: A determination regarding whether mitigation is required has not yet been made. If mitigation is required, the most likely area is currently thought to be enhancement of the wetlands on the south side of the landfill or in the Beaver Creek drainage above the Navy ponds.

Comment 3c. [Employee Briefing] Do you know if the stream on the west side of the landfill is picking up any leached material now?

Response: Most of the stream flow is rainfall runoff. The remedial action includes installation of a curtain drain (hydraulic cutoff system) around the perimeter of the landfill, including the west side. The curtain drain will be designed to intercept shallow groundwater and rainfall runoff prior coming in contact with the landfill.

4. Remedial Design Issues

Comment 4a. [Employee Briefing] Will the access road to the laboratory be raised along with the landfill?

Response: This is a design question that will be decided during the remedial design phase. It will either be left as it is and the landfill graded in or the road will be raised.

Comment 4b. [Employee Briefing] Do you know if PCB fluid is in the UST tanks? Will all fluids be pumped out of the USTs?

Response: When the concrete USTs were sampled and tested, sludge and PCBs were found in them. The sludge and PCBs will be removed prior to in-place closure of the USTs. Associated piping also will be removed if possible. If existing utility lines make it impractical to remove some piping, those pipes will be purged in-place and abandoned.

Comment 4c. [EPA FMSD] The master plan for the Manchester Lab calls for the expansion of existing laboratories which would require the construction of additional parking over the area of the landfill. Any remediation solution should not unnecessarily impinge upon the ability of the Manchester Lab to carry out its master plan. In this case, all proposed landfills should be designed and placed to a degree sufficient to support the proposed future parking areas.

Response: The landfill cap will be designed in such a way that it will be compatible with construction of a future parking lot on the northern portion of the landfill.

Comment 4d. [EPA Manchester Lab] A Facility master Plan for the projected use and expansion of the laboratory facility was completed in 1994. A copy of this plan was sent to the US Corps as a part of our original comments during the RI/FS comment period. The Master Plan contemplates a parking area immediately south of the laboratory for employee parking allowing building expansion to the north into the existing parking lot. We request that the landfill cap and new roadway be designed so that EPA can utilize this area as projected in the Master Plan. The proposed fill area should be designed so that the northern portion of the site is level and as near current grade as possible to allow for future utilization as the laboratory's parking area.

Response: See response to Comment 4c.

Comment 4e. [EPA OMP] Upon completion of the remediation, it appears that the main entrance road to the lab will need to be rebuilt above the proposed cap. Since the lab's Master Plan calls for significant construction in the future, the reconstructed road should be built to meet the same design criteria as our existing road, which is capable of supporting heavy equipment and tank trucks. If the roadway is to be re-routed, consideration must be given to the impact on the main lab entrance as described in the Master Plan.

Response: If the existing access road is demolished, an access road with the same design criteria as the existing road will be included in the design specifications.

Comment 4f. [EPA FMSD] Although the proposed plan indicates the cap will be designed to control infiltration of rainwater, the preferred alternative 3A does not specify that the cap will include revegetation. Please provide clarification on whether appropriate grading and revegetation will be included in the preferred alternative 3A for the landfill. In addition, consideration should be given to designing the fill contours to include berms to screen future parking, and allow the Entrance Road alignment and grades to enhance views

of Clam Bay and to promote safe traffic flow of employees and guests as well as service vehicles.

Response: Aesthetic concerns will be considered in the remedial design and will be coordinated with landowners. Appropriate grading and revegetation will be included as part of the landfill cap design. The Corps will solicit input from EPA (as property owner) through the Manchester Work Group.

Comment 4g. [EPA Manchester Lab] The design and construction of the landfill cap will affect the character of the laboratory and the site very possibly in perpetuity. The cap should include berms to screen some areas of the site. Road alignment and grades should promote safe traffic flow for employees, guests, and service vehicles and enhance views of the bay. We request that the landfill cap be designed with the assistance of a landscape architect to ensure that it is done in a functional and aesthetically pleasing way.

Response: See response to Comment 4f.

Comment 4h. [EPA Manchester Lab] A large (30-inch?) storm water drain line runs from just north of the Laboratory Annex Building to the southeast and into Clam Bay. This concrete pipe likely allows some backflow of seawater into the landfill. The possible leakage of the pipe could add water to the landfill or conversely, the pipe might act as a drain for it. This storm line drain (and any others) should be eliminated or rerouted.

Response: The need to plug and/or reroute existing storm drains in the vicinity of planned construction activities will be evaluated during the design phase. The Corps will coordinate with EPA Lab if the design team determines that modifications are necessary which could impact facility operations.

Comment 4i. [EPA Manchester Laboratory] We have technical questions and comments that we anticipate being addressed during the design phase of this project. Some of these questions and comments are as follows:

- a. The material on the beach, primarily consolidated metal debris, may be extremely difficult to break up, remove from the beach, and place on the upland portion of the fill. The material may be difficult to properly compact leaving voids present throughout the landfill. This could cause differential settlement and cracking of the cap. The structural stability of the fill could be particularly important if the access road is to be placed across it in its existing alignment. How do you plan to break up the debris material to spread it over the landfill portion of the site prior to capping?
- b. There are no details on the design fill except that it is anticipated that the fill will mitigate the concentration of metals in the seeps. The FS indicates at 4-12 that the fill should result in order of magnitude reduction in the concentration of seeps, thus meeting Remedial Action Objectives. There is no indication of what will happen if this does not occur or whether some subsequent remedial action would be required. The intertidal fill will apparently lower the tidal influence on the landfill. However, because it is "semi-permeable" the intertidal design fill will allow some infiltration into the landfill material at high tide or repeated high water, further contributing to seeps.
- c. There are no details on the nature of the dike to be constructed to protect the excavation from the tidal movement.
- d. There is no information on the relative importance of groundwater versus precipitation versus saltwater infiltration on creation of seeps from the landfill. We could not find technical information in the RI/FS about the groundwater flow in the landfill. It is assumed that the groundwater cutoff will result in a significant reduction of flow into the landfill and a resulting significant reduction of seeps.
- e. From the Feasibility Study, the cross section of the trench indicates that the trench is lined with a fabric but not an impermeable membrane. Therefore, this would appear to do little to cut off the groundwater except to provide an alternate, more permeable pathway for groundwater to leave the area. Since the trench is keyed into the sandy silt, it would appear that the trench is deep enough (elevations are not provided) to allow the free movement of saltwater back into the trench system at high tides. This would expose the landfill to an additional source of water which presently does not exist. Also, groundwater would not flow out of the trench at high tides. We would like to review elevations, slopes of the trench, and the construction details during the design. One suggestion is that the gravel cutoff trench be replaced with a slurry wall or some other form of an impermeable barrier to groundwater flow. The groundwater would be diverted around the fill as with the trench but in a more positive manner. A wall that would be keyed into the sandy silt layer and the design fill on the intertidal area would not provide a conduit for saltwater backing up into the fill. A slurry wall would be more expensive than the gravel trench and require more difficult and involved construction. An alternative would be the use of an impermeable membrane on the downstream, landfill side of the gravel trench. This would eliminate any groundwater flow into the landfill but would not eliminate potential flow of saltwater back into the trench system. Depending on the hydrogeology at the site, a drainage system may be necessary outside of the low permeable barrier surrounding the landfill.
- f. The specific design for the landfill cap has not been determined. The FS at 4.4 talks about the lack of a need for a RCRA cap on the landfill because lead levels in the seeps are below Remedial Action Objectives. However, several other metals and PCBs which are also of concern. The concerns for any cap are the requirements to protect against direct contact with the fill, the reduction of precipitation and infiltration, and stability and reliability over time. One of the decisions to be made during the design

is what type of a cap can meet these objectives.

Response: Comments noted. These concerns and questions will be addressed during the design phase. The EPA Lab will have an opportunity to review design and construction documents produced during the cleanup project.

5. Remedial Action Implementation Issues

Comment 5a. [Employee Briefing] I am concerned about the cleanup and tracking of mud from the contaminated area onto private vehicles, delivery trucks, and other vehicles entering and leaving the laboratory and the site during the construction activities. What will be done to eliminate the spreading of the contaminated soils and sediments out of the contaminated work area?

Response: A decontamination area will be set up to prevent movement of soils and mud outside the remediation area. Area access and movement of vehicles will also be controlled with temporary fencing.

Comment 5b. [Employee Briefing] There may be a lot of vibrations that affect some of the sensitive laboratory instruments during the cleanup construction activities.

Response: This will be addressed in the design phase, with the lab's input.

Comment 5c. [Employee Briefing] The Old Navy Dump/Manchester Superfund Site Schedule handout indicates that you plan to start the cleanup work in the summer/fall of 1998. How long will it take to move the shoreline debris and spread this material over the landfill area?

Response: Many details have to be considered before a reliable estimate can be made. It depends on the design and the contractor's capability. The diking and excavation of the landfill debris alone may take 6 months.

Comment 5d. [Employee Briefing] What kind of mechanical processes and equipment will be used to excavate the shoreline debris?

Response: We plan to construct a dike to stop the tidal flow to be able to work at the toe of the landfill. We anticipate the contractor will use a large piece of equipment to pull out chunks of debris, and that a hydraulic shear will be used to cut the material. The material will be consolidated on the upland portion of the landfill.

Comment 5e. [Employee Briefing] We are concerned about possible damage to the NMFS seawater lines that cross Clam Bay when the thin cap material is spread over this area. Can the thin cap material be installed without damage to our existing seawater lines?

Response: The design contractor will coordinate closely with NMF5 to locate the lines and ensure adequate line protection during construction. This may include doing the work at high tide.

Comment 5f. [EPA FMSD] Of primary concern during the actual remediation, is maintaining continuous and uninterrupted access to the lab. Adequate arrangement should be made for alternate access during the excavation in the shore area, landfill operations, and cap installation. Access through the State Park may provide an acceptable short-term alternative. The remedial design should also include reconstruction of the road system leading to the lab, from the Beach Drive entrance, through the landfill/work area, to the lab complex. Even if actual excavation and landfill take place in areas outside the road corridor, we expect that heavy construction equipment will severely damage the existing road.

Response: Continuous access to the Manchester Lab will be incorporated into the remedial design. Negotiation with the Washington State Department of Parks & Recreation are currently underway for a temporary access road, in the event that one is needed. If the existing road is damaged or demolished, it will be repaired or replaced in kind.

Comment 5g. [EPA Manchester Laboratory] It is very likely that the access road will be heavily affected during construction activities and will be unavailable for long periods of time. Since the laboratory will remain open during construction activities, what provisions will be made for continuous access to the facility?

Response: Continuous access will be provided. If the existing road needs to be closed or demolished as part of the cleanup project, a temporary access road will be constructed.

Comment 5h. [EPA OMP] During the remediation process, continuous access must be maintained for the Manchester Lab. This may represent up to 200 vehicles per day. What alternatives will be considered if Washington State Park denies permission for creation of a temporary access road through their property?

Response: Continuous access to the Manchester Lab will be incorporated into the remedial design. Negotiations with Washington State Department of Parks & Recreation are currently underway for a temporary access road. In any event, it is recognized that access options will be evaluated during the design phase.

Comment 5i. [EPA Manchester Laboratory] The laboratory will continue full operation during cleanup activities. Because of this we are concerned about the potential contamination problems that may arise in our chemistry area, particularly in the inorganic operation, when chemists are analyzing environmental samples during the cleanup. Our laboratory is capable of very low level analysis in the parts per trillion range. What steps will be taken to insure that laboratory processes are not compromised during remedy construction? Can a provision be made for stopping work if dust is generated that cannot be controlled using wetting or misting methods?

Response: (See also response to Comment 2g.) The Corps will do everything possible to minimize dust generation and migration. Performance standards will be developed for control of dust. The performance standards will be developed with EPA Lab input and documented in the RAMP. Corrective actions will be required, including stopping work if necessary, if these performance standards are exceeded.

Comment 5j. [EPA FMSD] It is not clear to FMSD that US Corps is fully aware of the existing system of utility lines that cross the Manchester Annex Superfund Site and considered them in the preferred alternative selection. As shown by Attachment A, an old storm drain line travels through the proposed landfill area. Also the water and sewer lines for the Manchester Laboratory are located to the east of and parallel to the existing EPA security fence. The location of utility lines should be considered during the design, construction, and post-construction phases of any remediation, with particular attention to maintenance of uninterrupted utility service during the remediation construction period.

Response: The Corps is aware of the utilities mentioned and will work closely with the EPA Manchester Laboratory and National Marine Fisheries Service (NMFS) to minimize impacts to existing utility lines at the site. Utility lines will be located and addressed in areas where remediation work will take place during the design and construction phases of the project. If interruptions or outages are unavoidable, the Corps will coordinate with the EPA Lab and NMFS to minimize the impact to EPA's and NMFS's daily operations.

Comment 5k. [EPA Manchester Laboratory] The pressurized water and sewer lines for the laboratory are located to the east of and parallel to the existing EPA security fence. Will these lines have to be moved as a part of the landfill capping work? If the lines must be moved, what provisions will be made to insure these services are available to the lab during construction activities?

Response: A relatively small quantity of landfilled solid wastes are located west of the utility corridor, on Manchester State Park property. Construction of a cap over the utility corridor should be avoided. The likely solution (to be determined during remedial design) will be to consolidate the wastes to the east side of the corridor prior to capping them. An alternative solution would be to relocate the utility corridor to outside the waste area. The Corps will coordinate with EPA Lab if the design team determines that it is necessary to move the lines. The Corps' goal will be to avoid any service interruptions to the labs on site.

Comment 5l. [EPA OMP] Will the existing water and sewer lines at the site risk compromise due to the remediation? If so, what provisions have been considered to ensure uninterrupted service to the lab?

Response: See responses to Comments 5j and 5k.

6. Post-Remedial Operation, Maintenance, and Monitoring Issues

Comment 6a. [EPA FMSD] Although FMSD is, via a previous administrative transfer, the owner of the Superfund site, FMSD recognizes that the U.S. Navy is solely responsible for the contamination at the site that is currently undergoing remediation pursuant to 40 CFR 300 under the Department of Defense (DOD) Formerly Utilized Defense Sites (FUDS) Program. In light of this, OA expects that the DOD FUDS Program and/or US Corps will also be responsible for post-remediation activities associated with maintaining the integrity of the preferred alternative, such as required operation and maintenance, long-term environmental monitoring future information reporting and review requirements, maintenance of institutional controls, and any other unforeseen remediation or environmental monitoring.

Response: The Corps will be responsible for operation and maintenance, monitoring, and reporting in accordance with an approved O&M Plan and the FUDS program requirements. The EPA Lab and other members of the Manchester Work Group will have input on the O&M Plan. Specific O&M requirements, including length and extent, will be determined after the details of the remedy are determined and designed.

Comment 6b. [EPA OMP] Once the remediation at the site is completed, I believe that there will be a continuing need for operation and maintenance, monitoring and recordkeeping, reporting, and possibly further remediation. This could result in a significant resource consideration. I would like to see these

responsibilities clearly delineated for DOD or US Corps, whichever is appropriate.

Response: The DOD is responsible for the cleanup costs under the Formerly Used Defense Sites (FUDS) program. See response to Comment 6a.

Comment 6c. [EPA Manchester Laboratory] We believe the US Corps as the Department of Defense (DOD) cleanup representative is responsible for any long-term operations and maintenance (O&M), monitoring, and recordkeeping that will be needed for this site forever or as long as the contaminated materials remain on our property. If the proposed alternative selected includes leaving the contaminated soils and sediments in the landfill, we request that the DOD assume full responsibility for the long-term maintenance of the site as an adjunct to their responsibilities for the cleanup.

Response: See response to Comments 6a.

7. Coordination with Other Agencies/Programs

Comment 7a. [J. Schmidt Manchester State Park] His concern was the impact the removal and disposal of material will have on the operation of the park. He informed us that we would need clearances prior to any work being done. He also requested that the following person be added to the mailing list for future information:

Mr. Chris Regan
WA Dept. of Parks & Recreation
7150 Clean Water Lane
PO Box 42650
Olympia, WA 98504-2650

Response: Appropriate clearances and/or leases will be obtained through coordination with Washington Dept of Parks & Recreation. Mr. Chris Regan will be added to the mailing list.

Comment 7b. [EPA FMSD] The remediation of the Manchester Laboratory site represents a situation where the goals and objectives of the various components of EPA may not be identical. For example, the goals and objective of EPA's Superfund Program may differ from the goals and objectives of the Facilities Management and Services Division (FMSD), as the title holder and owner of EPA's real property assets; EPA Region 10's Office of Management Program (OMP), as steward of the Manchester Laboratory; and EPA Region 10's Office of Environmental Assessment (OEA), as the occupant and operator of EPA's Manchester Laboratory. Therefore, future documents should specifically and clearly identify the particular roles of each EPA program or office making a decision, accepting a responsibility, or being made subject to restrictions in the course of the remediation process. For example, the proposed plan does not specify which EPA office is working with the U.S. Army Corps of Engineers to design and manage remedial activities, who is responsible for CERCLA enforcement, etc.

Response: In general when EPA is mentioned in memoranda, letters, and documents, they refer to EPA in the Superfund Program role. Otherwise, the specific offices will be distinguished if in such context or reference. In general, when the documents refer to EPA as a property owner, the term "EPA Lab" will be used. The Corps has requested that the offices representing EPA as property owner designate one point-of-contact (POC) to streamline the communication between EPA, FMSD OMP OEA, and the Corps. Having a primary EPA POC will allow the exchange of information to occur as efficiently as possible during design and construction.

Comment 7c. [EPA FMSD] As administrative controls or land use restrictions contemplated in connection with the proposed remediation will impose restrictions on FMSD, OEA, and OMP's use of the site and future expansion of the Manchester Laboratory, FMSD, OEA, and OMP should be involved in establishing any administrative controls or land use restrictions affecting EPA's site and participate in the development of any long-term administrative controls imposed on the landfill, curtain wall, and cap areas. Any proposed land use restrictions should be clearly and officially communicated to FMSD, OEA, and OMP.

Response: The Corps will coordinate with property "owners," including EPA, regarding any long-term proposed land use restrictions at the site.

Comment 7d. [EPA FMSD] Obviously, design of the final remediation will involve many decisions that affect the short-term and long-term functioning of the Manchester Lab. FMSD, OEA, and OMP should be heavily involved as the design of the Remedial Plan moves forward.

Response: EPA (as property owner) will receive draft copies of design documents for review, and their input will be solicited through the Manchester Work Group. In addition, the Work Group will be provided periodic briefings on the design.

8. Other Issues

Comment 8a. [EPA FMSD] FMSD and OMP are currently working with the State of Washington to obtain a renewal of the tidelands/bedlands lease connected with the laboratory's pier. Any remediation plan should not contain any provisions which would prevent FMSD and OMP from obtaining a renewal lease, and should address any concerns the State of Washington has regarding contamination of the tidelands/bedlands in this area of Clam Bay.

Response: Cleanup of the Clam Bay tidelands/bedlands has been coordinated with the State of Washington Department of Natural Resources (DNR), which is represented on the Manchester Work Group. Since the cleanup project will stop the source of contamination to the tidelands and remediate a portion of the tidelands, it should not have any adverse impacts on lease renewal and may be beneficial in obtaining a renewed lease.

Comment 8b. [EPA OMP] My office is working with the Washington State Department of Natural Resources to renew a lease for the tidelands and bedlands beneath the laboratory's pier. Any remediation undertaken should address any concerns DNR may have with regard to future contamination of the tidelands/bedlands so that it does not preclude the issuance of a lease for the tidelands/bedlands.

Response: See response to Comment 8a.

Comment 8c. [EPA Manchester Laboratory] When this site was listed on the National Priorities List, the laboratory's internal hazardous waste generator identification number was used in the preparation of the listing. The laboratory generates hazardous waste as a part of our internal laboratory activities and this waste stream and associated records must be maintained separately from the Old Navy Dump-Manchester Annex Superfund site-generated waste. Hazardous waste that was generated by the US Corps during the site investigation activities and waste that will be shipped off site for disposal as a part of the Old Navy Dump-Manchester Annex Site cleanup process must have a separate hazardous waste generator identification number in order to maintain separate records and appropriate responsibilities for this waste.

Response: The Corps has obtained and is using a separate hazardous waste generator identification number for waste generated during investigative and cleanup activities. Storage and disposition of wastes generated during cleanup activities, and any reporting requirements, will be the responsibility of the Corps.

The Corps feels the selected remedy provides a cost-effective program for reducing site risk. In general, the public who have commented on the proposed cleanup plan have been supportive.